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PAVING SEWERAGE

MUNICIPAL ENGINEERING

WATERWORKS PARKS

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SANITATION,
BRIDGES.

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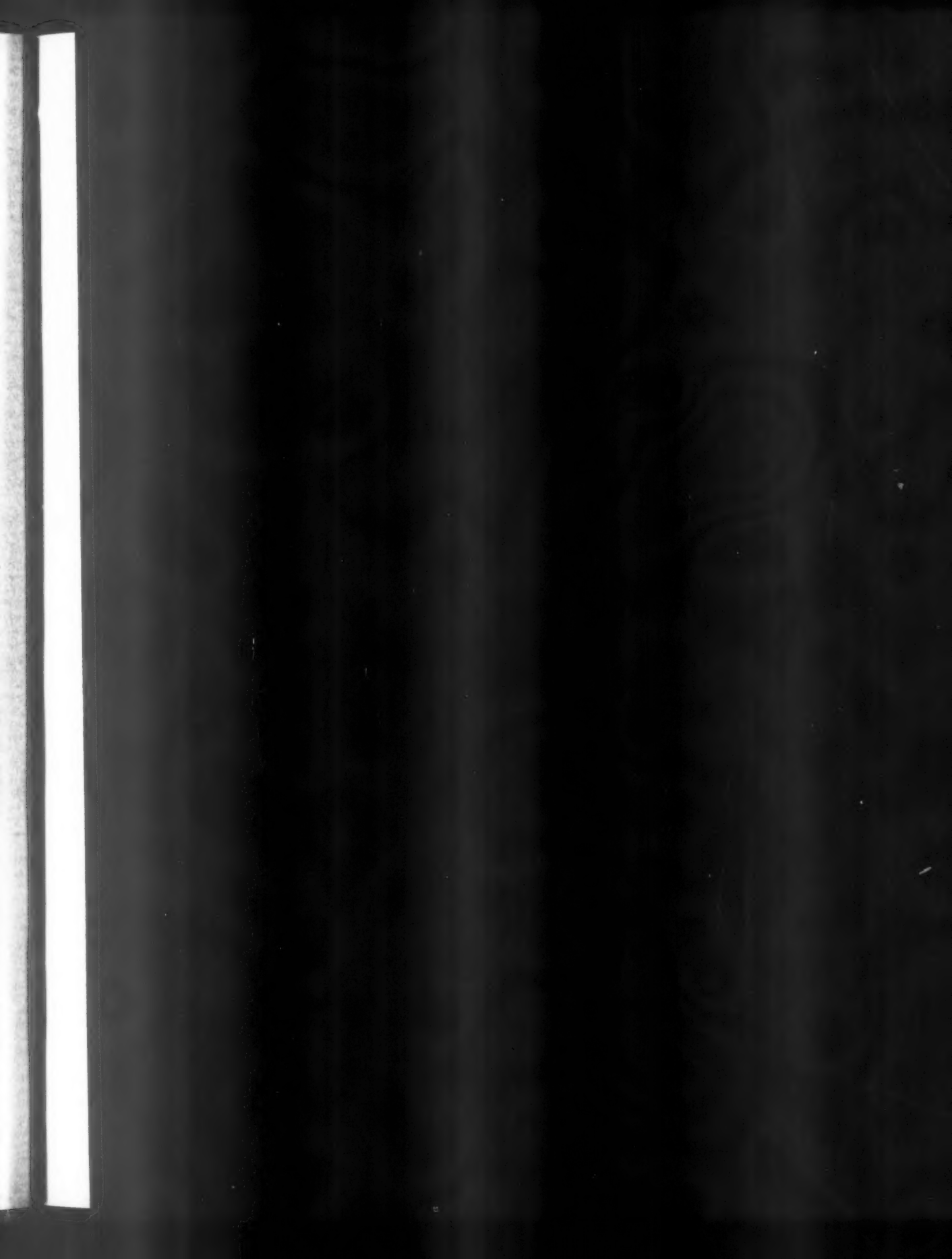


Municipal Engineering

VOLUME XVIII. APRIL, NINETEEN HUNDRED. NUMBER 4.

A METHOD OF COMPARING RATTLER TESTS OF PAVING BRICK.

By Daniel B. Luten, Instructor on Roads and Pavements, Purdue University.

The National Brick Manufacturers' Association adopted in February, 1897, specifications for a standard rattler test on paving brick, to consist of tumbling the brick for 1,800 revolutions, at 30 revolutions per minute, in a foundry rattler having a chamber 20 inches in length and 28 inches in diameter; a charge for one test to consist of a sufficient number of brick to fill 15 per cent. of the volume of the rattling chamber.

This standard was adopted as the result of experiments by several investigators. The results of the most important of these experiments made by Prof. Orton, of Ohio State University, and Mr. Harrington, of the St. Louis Testing Laboratory, were published in the 1897 Proceedings of the National Brick Manufacturers' Association.

City engineers have been somewhat slow to adopt this standard test, and for two reasons—because further investigation seems to have shown that the above test is not always reliable, nor as satisfactory, perhaps, as a modified rattler test, and because of lack of facilities for performing such tests. That the standardizing of the rattler test in that form was premature is evidenced by the fact that other forms of rattler test are being investigated by the National Brick Manufacturers' Association, with a view to deciding upon a more satisfactory test, and city engineers are awaiting this decision before investing in testing apparatus.

There is, however, but little doubt that the present standard rattler test is a more satisfactory test of the wearing qualities of paving brick than tests by absorption, crushing, cross-breaking, etc. The writer feels, therefore, that while the discussion that follows may sooner or later become valueless through the discarding of the test to which it applies, it may, nevertheless, be of use for a time, to such as continue to use this test in preference to a change to one that may be more difficult of application. More especially, as the most of those city engineers that are using a rattler test are applying not the conditions of the N. B. M. A. standard, but a modified test instead, made necessary by the fact that the rattlers that they use are such as can be rented in neighboring foundries, very few cities having their own apparatus for performing this test.

It is not to be expected that rattlers can be thus obtained that will conform to the N. B. M. A. standard in all particulars.

Fig. 1 shows the rattler in use at the testing laboratory of Purdue University for testing paving brick. It is built according to the N. B. M. A. standard specification, and is mounted on an overhung shaft with an opening at the end for admitting the brick.

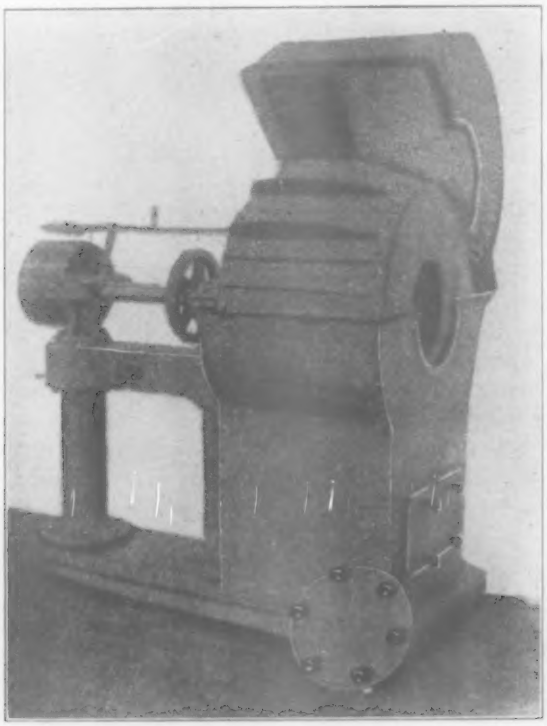


FIG. 1.

Fig. 2 is a foundry rattler in use by one city engineer for testing paving brick; it is 24 inches in diameter, 38 inches in length, and is run at about 25 revolutions per minute. A test with this rattler will not of course give the same per cent. of loss on a given variety of brick as a test with the standard rattler; the city engineer who employs this rattler has, however, made a larger number of tests upon brick varying greatly in quality, and knows, therefore, what loss may be expected for a good brick. He has thus adopted a standard of his own; he has, however, no means of comparing the losses according to his standard with those obtained from tests made according to the N. B. M. A. standard. And a change to another form of rattler test would necessitate a large number of tests to again fix a standard for this particular rattler.

Fig. 3 represents another rattler which varies still more from the N. B. M. A. standard; it is 34 inches in diameter, is 48 inches in length, and rotates at about 20 revolutions per minute.

In the University of Illinois Technograph for 1896, Mr. Burt states that, in reply to his requests

STEEL TIE CONSTRUCTION IN CONNECTION WITH BRICK PAVEMENT ON EAST MAIN STREET, ROCHESTER, N. Y.

for information on this subject, 15 city engineers had given the dimensions of rattlers in use by them in 1895, ranging as follows:

Length of rattler	24–54 in.
Diameter	15–40 "
Revolutions per minute	15–55.
Duration of tests	30–360 min.
Weight of iron	50–800 lbs.
Loss permissible in one hour	3–10 per ct.

The standardizing of the rattler test with unmixed charge has doubtless operated to modify the tests, as reported by Mr. Burt; such modifications as a reduction to eighteen hundred revolutions, limiting the speed to thirty revolutions per minute and omitting the scrap-iron frequently used in the charge, might be easily made; to secure standard length and diameter, however, would not be so easy a matter; and, although the standard was adopted three years ago, many of the old rattlers are still in use. Present indications are that the National Brick Manufacturers' Association will modify the present standard by the introduction of a mixed charge consisting of brick and cast-iron shot, in eight-pound and one-pound sizes, whose principal advantage is in the smaller number of brick required for a test.

The writer is of the opinion that no rattler test will prove satisfactory without a recognition of the variations of the individual brick composing a charge; and that, if these individual variations be measured, the rattler test, with unmixed charge of, say five per cent. of the volume of the rattler, will prove as satisfactory and more simple than the test with mixed charge. Any proposed standard will, however, require considerable investigation before it will be accepted by engineers generally as being sufficiently reliable to warrant their changing from present methods.

FIG. 2.

It is found, for example, that a city of 500,000 inhabitants, using brick extensively for street paving, makes no tests of any kind on paving brick, because, as the city engineer expressed it, no test has been proved satisfactory. Another city of about the same size specifies the absorption test alone, with a requirement of less than two per

BRICK PAVEMENT ON EAST MAIN STEET, ROCHESTER, N. Y.

cent. absorbed in four days; and the city engineer, while admitting that this test is unreliable and even misleading, says that the department has no appropriations for providing a more satisfactory test.

The city engineer of a neighboring city of 100,000 inhabitants applies a rattler test with a rattler that is not according to the N. B. M. A. standard, and last summer specified that the loss for 1,500 revolutions should be not more than 24 per cent. Only one variety of brick was able to meet the requirement, although other manufacturers of good paving brick tried again and again. Prices rose as a consequence and the engineer was obliged to modify his specification to 26 per cent. loss.

FIG. 3.

Prof. Orton's investigations to determine a standard test were made upon Canton brick, all of which had been selected from a central portion of the kiln, and were consequently as nearly uniform in quality as it is possible for paving brick to be. Of ten tests conducted according to the N. B. M. A. standard, the maximum loss varies from the minimum by but 4 ½ per cent. of the original weight. Prof. Orton has shown in these experiments that the loss per cent. for rattlers of different length, all other things being equal, varies inversely with the length, but is practically constant for a charge which bears a constant ratio to the volume of the rattling chamber; that the loss per cent. increases with the diameter of the rattler up to 28 or 30 inches, and then decreases slightly for rattlers of greater diameter; that the loss increases with the number of revolutions; that the loss is different for different volumes of charge being a maximum, when the charge occupies about 15 per cent. of the rattling chamber; and that the loss increases slightly for increased speed, but is practically constant at from 24 to 36 revolutions per minute.

The tests made by Prof. Orton may be made the basis for a comparison of the results of different sizes of rattlers, of different volumes of charge, and at different numbers of revolution.

In Fig. 4 the losses per cent. on charges of a standard brick tested in rattlers of different diameters, with the other conditions uniform, are platted as ordinates, the diameters of the rattlers being the abscissæ, and a curve drawn as nearly

LAYING ASPHALT PAVEMENT ON WEST MAIN STREET, ROCHESTER, N. Y.

as possible through the points. Now, on the assumption that if one variety of brick loses half as much as another in a 16-inch rattler, it would also lose half as much in a rattler of any other diameter, the other curves of Fig. 4 are drawn. If, then, a certain variety of brick loses 10 per cent. in a 16-inch rattler, all other conditions being standard, the corresponding loss for a 28-inch rattler is given by following the curve which passes through 10 per cent. for 16-inch diameter to its intersection with the ordinate for 28-inch diameter, which gives 39 per cent. as the corresponding loss by standard test. A 20 per cent. loss in a 24-inch rattler would correspond to a 26 per cent. loss in a 28-inch rattler.

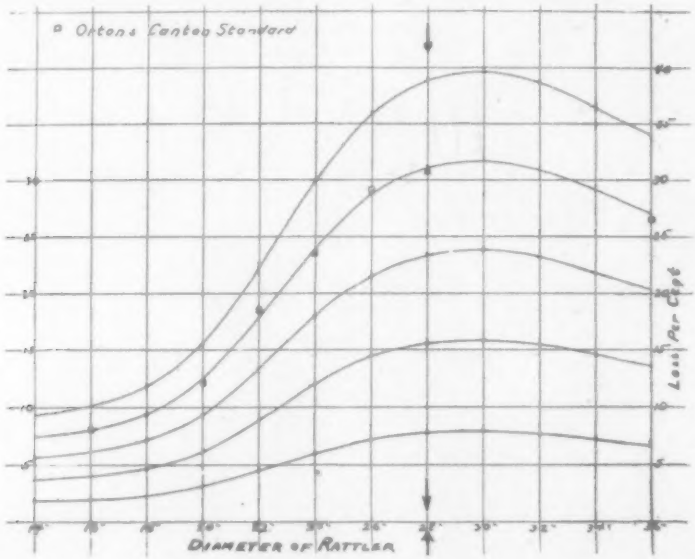


FIG. 4.

In Fig. 5 the small square platted on points of Prof. Orton's tests with 28-inch rattler, for 1,800 revolutions, the volume of the charge varying from 5 per cent. to 30 per cent. of the rattling chamber. The losses per cent. are platted as ordinates, the per cent. of volume of charge being the abscissæ. These tests were made on a standard brick, showing an average loss for the N. B. M. A. standard test of about 27 per cent.

The triangular points platted on this diagram are the losses in a similar series of tests by Mr. Harrington on a carefully assorted standard brick which was rather tougher than the other standard brick and gave an average loss of about 22 per cent.

Passing curves through these two series of tests, supplementary curves may be drawn by interpolation; and the relative losses for different per cents. of volume of charge may be found by following the curve from the ordinate given to that required. If a certain variety of brick lose 10 per cent. for a 5 per cent. charge, the corresponding loss for a 15 per cent. charge, all other conditions being standard, would be 21 per cent. For a 20 per cent. loss with a charge of 25 per cent. of volume of chamber, the corre-

ASPHALT PAVEMENT ON WEST MAIN STREET, ROCHESTER, N. Y.

sponding loss for a 15 per cent. charge would be 23 per cent.

In Mr. Harrington's experiments, the loss of many of the tests was measured for every 200 revolutions, and the characteristic curves platted, in which ordinates represented loss per cent. and abscissæ represented revolutions. Prof. Hart, in a series of experiments on twelve varieties of paving brick tested in the laboratory of Purdue University, platted the characteristic curves of revolutions, the supplementary curves are drawn. This assumption is allowable for tough brick, but may be very much in error for soft or brittle brick. If, then, a brick lose 20 per cent. for 1,200 revolutions, the corresponding loss at 1,800 revolutions is shown by the diagram to be 25½ per cent.

In Fig. 7 the three diagrams of Figs. 4, 5, and 6 are combined in one, the diameter curves being represented by light full lines, volume

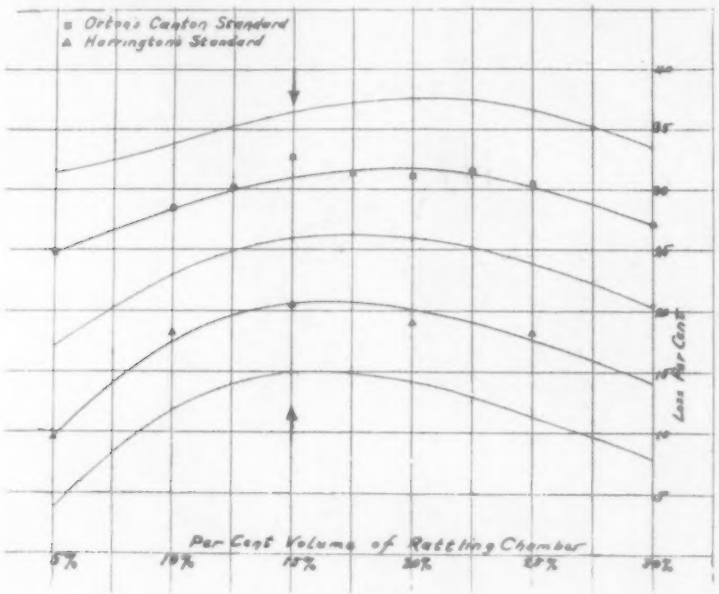


FIG. 5.

for 26 N. B. M. A. standard tests. From an examination of the curves determined by Mr. Harrington and Prof. Hart, the writer has chosen an average curve which may be very closely represented by the curve, $y^5=x^3$, the unit for y being 200 revolutions, and the unit for x 5 per cent. loss. This curve is shown on the diagram of Fig. 6. On the assumption that a brick which loses a certain proportion of the loss of another at a given number of revolutions will lose in the same proportion for any other number

curves by heavy full lines, and revolution curves by broken lines.

Those who are familiar with methods of rattler tests on paving brick are aware that erratic results are by no means infrequent; they will understand, therefore, that the above curves can not be more than a guide in guessing at the true result, and no great accuracy for all cases is claimed for them. It may be said in their favor, however, that they are deduced from tests on brick of very uniform quality, and that the primary curves may

LAYING MEDINA BLOCK STONE PAVEMENT ON EXCHANGE STREET, ROCHESTER, N. Y.

consequently be considered practically free from erratic tendencies; but in drawing the supplementary curves assumptions have been made as stated, which are probably justifiable, but which have never been proved to be so; and no other experiments have been conducted which can be used to check the accuracy of the diagrams. On account of the unwarranted severity of the present standard test, erratic results will occur, which can not be expected to conform to the diagrams; the engineer must use his judgment in applying the diagrams to such cases. For example, if one or more brick of a charge were to crumble away at the end of eight or ten hundred revolutions, the revolution curves could not be relied upon to give relative losses for the entire charge; but in such a case the brick would probably be rejected on account of lack of uniformity; or, if the weight and loss of the crumbled brick were eliminated, the curves might apply with sufficient accuracy to the remainder of the charge.

It must be noted also that each of these sets of curves is drawn for all conditions but one in accord with the standard test; they can not, therefore, be relied upon necessarily to give accurate results when two or more of the conditions are not standard. And examples may be chosen which show that the curves do not apply to such cases, since they give different results if the order of application of the corrections is changed. For example, the loss for a 30 per cent. of volume charge of brick tested in a 20-inch rattler, was 7 per cent. at 1,200 revolutions. Correcting first for diameter, then for volume, and finally for revolutions, the corresponding loss for standard conditions would be 31 per cent. If, however, the correction for volume be applied first, then revolutions, and then diameter, the corresponding loss would be found to be 44 per cent. The

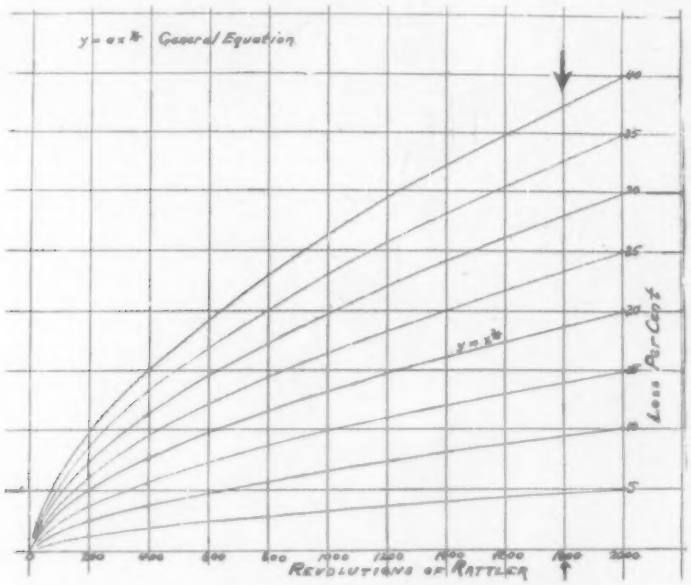


FIG. 6.

more accurate result will be given by applying first that correction which most affects the final result. In the given case the 7 per cent. should be corrected first for diameter; since the corrections for volume and revolutions affect the result to about the same extent either one may be applied next; but a more accurate result would doubtless be obtained by applying volume first, then revolutions, and then repeating the operation with revolutions first, then volume, and taking the average of the two.

Thus the 7 per cent. loss would correspond to 18 per cent. loss for a 28-inch rattler; 18 per cent. at 30 per cent. volume corresponds to 24 per cent. at 15 per cent. volume, which at 1,200 revolutions corresponds to 31 per cent. at 1,800 revolutions. Taken in the other order, 18 per cent. at 1,200 revolutions is the same as 23½ at 1,800 revolutions, which for 30 per cent. volume corresponds to 28½ per cent. loss at 15 per cent. volume. The average of 28½ and 31 would give the probable loss for the standard test. This example was purposely chosen as an extreme case.

If used with careful judgment the diagrams may have value when more than one of the conditions varies from the N. B. M. A. standard.

It will be seen by referring to Fig. 5 that the greatest discrimination between hard and soft brick is shown for a charge of 5 per cent. volume. If the tests by Prof. Orton and Mr. Harrington for 5 per cent. volume were accurate and reliable, this would be a strong argument for reducing the volume of the charge from 15 per cent. to 5 per cent. of the rattling chamber. Other arguments, as increased simplicity, and less severity with fewer accidental losses, would favor this change. But the evidence is incomplete, as bearing on only two varieties of brick, and further experiments would be necessary to prove its value. It is suggested here as a field for investigation.

NEEDED CHANGES IN THE METHODS OF TESTING PAVING BRICK.

The recent report to the Illinois Society of Engineers and Surveyors by the committee on paving brick specifications and tests is of such interest that the main part of it, as furnished MUNICIPAL ENGINEERING by the chairman, Mr. A. N. Talbot, professor of municipal and sanitary engineering of the University of Illinois, is published in full, as follows:

"While the committee has not been able to complete the series of tests planned, the new tests made all go to confirm the position taken in the former reports of this committee, that the rattler test adopted by the National Brick Manufacturers' Association, which discarded cast-iron shot and used brick alone in the rattler, is inefficient and misleading, and should not be accepted by engineers, and that the method recommended by your committee, and known as the University of Illinois method, using a mixture of large and small cast-iron shot of standard form, gives a more satisfactory test of the brick than any other yet proposed.

"To restate the principal objection to the method adopted by the

National Brick Manufacturers' Association: The test may fail to detect soft and brittle brick, and in general does not make a sufficient distinction between inferior and good grades. Tests made by the N. B. M. A. method since the last meeting on brick called by the maker as entirely too soft for paving purposes showed less loss than the maker's selected paving brick, and brick which had given unsatisfactory service in pavement outranked two superior makes of known value and reputation. Such results and those of other experimenters justify the criticism heretofore made on this method. Investigations also confirm the claim that the University of Illinois method detects softness and brittleness and has correctly measured wearing qualities. The committee is of the opinion that the use of standard amounts of standard forms of cast-iron shot, mixed in such proportions as to give a proper relation between the impact and the abrasion action, offers the best method of making the rattler test so far devised, on the score of convenience, fairness, ease of securing standard abrasive material, detection of soft and brittle brick, and measurement of toughness and ability to stand both impact and abrasion.

"The committee has considered the desirability of recommending that the society adopt the University of Illinois method, but has felt that the time is not yet ripe for taking such action. Besides, the criticism made upon the N. B. M. A. method by the chairman of the committee and others has caused the National Brick Manufacturers' Association to make a second investigation, which includes the test of the Jones rattler, and as it is known that these tests are quite extensive it seems possible that the results may commend a new form of rattler or lead to action in harmony with the views of this society. The committee is informed that these investigations have recently been completed and that the results will soon be made public. The committee hopes that a standard method may be recommended next year.

"The committee desires to call the attention of the society to the effects of moisture in brick in the rattler tests. Wet brick lose less than dry. Soft brick saturated with 8 per cent. of water lost only 67 per cent. as much as brick from the same lot tested dry. This percentage of wet to dry was about the same in tests made by the University of Illinois method and by the N. B. M. A. method, but by the latter method the wet soft brick gave smaller losses than did the best grade of the same make of brick, while by the University of Illinois method the wet soft brick still gave a loss nearly 50 per cent. in excess of the best grade. While the effect upon brick of low absorptive power is probably quite small, these results show the importance of having uniform conditions of moisture, and specifications should require that brick be thoroughly dried before being tested. What the cause of this difference in loss in wet brick may be is an interesting question. Quite likely much of it is due to peculiarities in the testing processes. The results all go to show that much has yet to be learned concerning the properties and tests of paving brick, and that here is a profitable field for the investigator."

BEST METHODS OF BOOKKEEPING FOR PUBLIC LIGHTING COMPANIES.

By John Lyle Clough.

Charles Lamb's witty observation, on the return of one of his precious volumes, that most of his friends were poor accountants, but they were nearly all good bookkeepers, if applied to a large class of present day business men would be met by a chorus of denials; and yet it might not be a very difficult matter to establish the truth of just such a statement if there were any glory or profit to be gained from the discussion. The successful business man is usually a man of affairs and not of figures. His time is more profitably employed in realizing profits than in recording them. If the details and minutiæ of a set of accounts are permitted to engross his attention, they are apt to prove too distracting to admit of an exercise of his powers in other directions equally or more important, and so he is forced to neglect one or the other phase of his duties. Naturally the one most easily delegated to a paid employe will yield. He perhaps recalls the time when his accounts were carried in his head, and though his business may have grown, he is still disposed to feel that a poorly-paid bookkeeper is more than sufficient to his needs. He easily finds just such a man, who is installed forthwith. With the complex relations of present day commercial life, however, have arisen many new conditions, which make necessary the adoption of new methods and a reshaping of old ones. This evolution is frequently a tedious and painful one, marked by many compromises and half-way measures before it is finally accomplished.

Reduced to its simplest elements a "set of books" is a written memorandum of a transfer of values between two or more individuals, or accounts which are treated as individuals. The process becomes more involved and intricate as the accounts increase and the values treated become more abstract in their nature, requiring an elaborate system of accounts to keep the skein from a hopeless tangle.

Years ago, the writer, as a child, was allured by marvelous tales of plenty into a visit to a famous peach orchard in the neighborhood, which was then yielding its first and only crop of delicious fruit. The scene was one that could not be forgotten, at least by a boy who was partial to peaches. From the orchard, located on the top of the precipitous hill overlooking the Ohio, descended every minute or two a huge tramload of fruit, which was shot down the inclined plane railway to the loading pier at the water's edge. The car was quickly emptied and jerked back again to the level of the orchard by the descending car on the opposite track. The fruit was ripening faster than it could be picked and marketed, and must be handled rapidly, if at all. The assorting of it was a task requiring the greatest care and judgment, and this was immensely facilitated by a simple and most ingenious machine. This machine was nothing more than a series of revolving rollers of varying diameters with

bins or baskets beneath—a common enough device in fruit-growing countries perhaps, but new in that region at the time.

The fruit was dumped upon these rollers and gently agitated and pushed along until it reached a point where it could fall through. While it was seeking a resting-place with other specimens of the same size, the watchful eye of the attendant scanned it for a possible blemish or tendency to over-ripeness. If it was perfect, it was, without being touched, deposited carefully in its proper place in the basket beneath, and was ready for shipment. What that little machine was to the fruit-grower, a well-considered system of bookkeeping is to the business man. A system that will cause every item of his business to come under his personal eye at the time of the transaction, without the necessity of his handling it himself, and that will finally land each one in precisely the spot in his ledger that it belongs in, is a good system for him. Most business men want such a system; a few of them have it. It may be fairly said, though, that a vast number of them are doing twice as much bookkeeping as their business demands—but very little accounting in the true sense of the term—for a good system saves labor rather than increases it. Stroll down one of the wholesale streets of the city almost any night along toward bed-time, and glance in the offices in passing. Some of them are dark, but others are not. Who is it that is toiling away by the light of the solitary gas jet in the rear? The ookkeeper, of course. Why should he have to toil while the rest of the office force is at home in bed?

His work may be, and often is, too heavy, or he may be simply slow, or he may be a poor manager. Or, perhaps, he glories in the fact that he averages sixteen hours a day in the office, as some of his class do, and deliberately chooses this way of showing his zeal for his employer's interest. Most likely, however, he is keeping the record of a nineteenth century business with an eighteenth century system. He may not know how to improve it, or, if he does, his employer is prejudiced against new-fangled ideas of bookkeeping and will not consent to a change.

Such a state of affairs is not surprising, but is, on the contrary, what might be expected. For in the nature of things there can be no hard and fast rule laid down for the keeping of any set of accounts which can be said to be the one and only correct way of doing it. The same thing may be done in a hundred different ways, one of which may be better than the rest, but opinions will differ as to which one that is.

In some branches of business much more study has been given to the science of accounting than in others. Most banks, for example, use specially-designed journals, ledgers, balance books and registers, which reduce the vast labor of keeping their accounts to a remarkable extent, making it possible to render a statement of their condition within a few minutes of the close of banking hours each day. Where so large a proportion of the expense of carrying on a business is chargeable to the bookkeeping department, as in a bank, this saving is an important item. Similarly, large mercantile establishments are more and more coming to use the more elastic and economical devices of the day. The loose-leaf order-blank and sales-book, the loose-leaf card index, or

other forms of perpetual ledgers, the special-ruled cash books and journals, have all contributed their share in the general tendency toward improvement. There is room for still further progress in some directions, however, as was evidenced some years ago, when Municipal Engineering Co. offered prizes for the best sets of forms for the use of water-works companies. Of the many forms submitted, some were most excellent, while many others were fairly good. A few of the forms, however, were so utterly bad that they suggested an interesting speculation as to what the forms might have been which were not considered meritorious enough to be entered in the competition at all. As a general rule the larger cities employed more elaborate and carefully considered blanks than the smaller towns, though there were striking exceptions to the rule in both directions.

The most remarkable fact brought out by a comparison of the forms submitted was that there was seemingly an entire lack of uniformity of practice by the companies under consideration. There was no generally accepted method of keeping any particular record and there were almost as many different styles of forms as there were entries in the competition. Many of the forms were devised by the superintendents, whose training had fitted them more particularly for the management of the physical details of the plants under their charge than for the clerical duties of their position. The result of their independent action and lack of interchange of views, and failure to profit by the experience of others, led to the adoption of systems which were cumbersome and wasteful in the extreme. The descriptions of some of the better forms which were subsequently published in MUNICIPAL ENGINEERING attracted a great deal of attention and served to crystallize sentiment along certain clearly defined lines. It also created a demand for information of the same kind, more especially adapted to the use of gas and electric lighting and power companies, and many inquiries have been received for some method of applying the principles pointed out to a system of forms which the latter companies might use either in whole or in part. The publishers of MUNICIPAL ENGINEERING have determined, therefore, to collect the necessary data by means of cash prizes, as announced elsewhere, and give to the readers of MUNICIPAL ENGINEERING the full benefit of the information thus obtained. The best of the forms submitted will be described and discussed in these columns, and their publication can not fail to be of great assistance, not only to the many who are known to be seeking such aid, but to others who have been heretofore in blissful ignorance of the shortcomings of their present methods.

COMBINATION OF CENTRAL STATIONS OF ELECTRIC LIGHT AND WATER-WORKS PLANTS.*

By Louis E. Fischer, C. E.

The creating of too many city departments is a complication of a city government which must necessarily prove expensive, due to the duplication of parts and employes and the probable strife, not for the best results, but for favors from the municipal government by the heads of these departments. This, of course, is not so much the case in larger cities as in smaller cities. In fact, the magnitude of any department of public service in a metropolitan city is such that it ought to be made a paying institution as a unit.

The two leading public service products are light and water. Both of these are essential to the maintenance of the city. Both of them are supplied from central stations. The night consumption of water is materially less than the day consumption. The total light output is in the night. These facts afford the means for the combination of central stations by the utilization of a common plant for the operation of pumping machinery and lighting apparatus. It will be readily seen that local conditions and the size of the city will limit the extent of such combinations, but with the development of large units, both in electrical apparatus and pumping machinery, and in high voltage transmission, it is probable that combined central stations will eventually replace the numerous smaller stations in larger cities with economical results. However, as all the larger cities have already their established municipal water-works systems, the present field for combined plants is limited to smaller cities.

The principal advantage of a combined station is the reduction of cost of the public service to the taxpayer, brought about by,

1. A reduction in the first cost of the building and the steam plant.

2. Utilization of the surplus boiler capacity and surplus time of employes during the minimum water pumpage, for the light output.

3. The existence of but one management, which can better utilize the employes to an advantage at all times.

Taking up the first of these, it is evident that it is an item of considerable importance. One of the essentials of a steam plant is the duplication of the boilers to facilitate cleaning and repairing. Hence, where the construction in a single plant is twice the actual needed capacity, in the existence of separate central stations for these two public service institutions, the first cost would be practically four times the cost of the actually needed boiler plant. Furthermore, a building for a municipal central station should be substantial and handsome, hence expensive, thus another large saving where one will answer for two.

In the second item, the utilizing of the surplus time of the employes is of considerable import. The attendants of pumping machinery and electrical apparatus, owing to the development of self-oiling journals and automatic regulators, have

* From paper read before the Illinois Society of Engineers and Surveyors.

nothing much to do but watch the wheels turn and see that the oil-ways are clear. Yet they are essential and must be men of intelligence, hence demand considerable compensation. In a combined central station, one force of men can practically accomplish the same results that two similar forces can in separate plants. This is not so true in the boiler-room, for with the additional coal consumption, additional stokers are required.

The greatest saving, however, can be effected in the third instance. Having a man of ability at the head of a department is essential to its success. Such a man demands a salary that forms a considerable portion of the cost of maintenance of a public service institution in a smaller city, likewise so with his assistants. Therefore, a reduction in the number of heads, by the combination of departments, will reduce this cost materially. The principal objection to the small municipal industrial plant is the fact that the volume of business does not permit the paying of sufficient salaries to engage the services of competent superintendent and engineers. As is often the case, some alderman will have a son (an electrician, due to the fact that he once connected up a bell to a battery, which rang) who is made superintendent of the electric light plant at a meager salary. For a water-works superintendent, the engineer of Bill Jones' grist mill is chosen, because he can run a threshing machine, and once saved a child from drowning. The alderman, perhaps a grocer, who suddenly finds himself the chairman of the commitee on water-works, is ordered to alter this department. (He is probably like the alderman who, on his first inspection trip to his water-works, noticed a duplicate battery of boilers. In reply to his inquiry, he was told that only one battery was needed at a time. He then saw the steam-gauge, which read one hundred pounds. In his desire to be of great public service, and adopt some new original policy, it suddenly dawned upon him to order both boilers run at fifty pounds pressure.)

Local conditions must govern entirely the arrangement of parts in these combined plants. Where the supply of water is some distance from the city, it is probably better to locate a central plant near the city, where it is in close proximity to railroads, and put in a sub-station of electrical pumping apparatus at the supply of water, provided that the water consumption is not too great. Such electrical pumps are made for a capacity as high as 3,000,000 gallons a day, and give a duty of from twenty to fifty, depending upon the type of engine and electrical apparatus. However, if the plant can be located on a railroad, it is probably better to have the boiler plant at the supply of water, then pump the water direct with steam pumps and transmit the electrical output to the lighting center by high voltage transmission.

The choice of pumping machinery is not nearly so difficult and important a matter as the choice of electrical apparatus. The ultimate product of all pumps is identical, so the choice is confined to the best size and highest duty. With electrical apparatus, however, the product in the form of light is entirely dependent on the system. Where public lighting plants are confined to arc lighting, the best system to adopt is probably the series arc system, operated by direct constant current, the light thus produced being

the most brilliant. In connection with this system the use of an enclosed arc lamp on six and six-tenths ampere current is preferable to an open arc lamp using nine and six-tenths ampere current, from the fact that there is less line resistance, great economy in carboning, and the light furnished is more uniform and better diffused.

With the development of multi-circuit arc machines in which the output is split on the commutator into a number of circuits, the use of larger units has become practical, hence the attainment of higher efficiency. However, the comparative low efficiency of constant current machinery, the maximum of which is about 87 per cent., is one of the objections to it. Where both arc and incandescent lighting is done, probably the best system is the series inclosed arc lamp on a constant alternating current, and incandescent lighting from high voltage transformers. By this system one large unit of high efficiency can be utilized for both kinds of lighting. The output of a machine primarily is a single phase alternating current of high voltage. The incandescent lighting is done by transformers as with all alternating systems. The series arc lighting is obtained by the transformation from the single phase alternating current to a constant alternating current by special transformer. Another good method of securing both arc and incandescent lighting from one system in smaller cities is by the use of three-wire 440 volt 220 volt system. By connecting across the outer wires, five constant potential inclosed arc lamps can be placed in a series. By connection across the neutral and either outer wire two 110 volt incandescent, or one 220 volt incandescent lamp can be placed. The quality of light from such a system is very good, the copper cost being the disadvantage. However, the engineer must determine which is the most applicable system by studying carefully the local conditions.

One of the few combined municipal plants in Illinois is located at Paris. Here there are in use two duplex, direct-acting Blake pumps, of one million gallons capacity, one 125-horse-power, high-speed engine and one 59 kilowatt direct constant-current electric generator, operating approximately one hundred lights. The duty of pumps is very low, being about 7½. The commercial efficiency of the electric plant is about 85. The plant is located about a mile and a half from the city, to which point the coal is hauled by wagons, making the coal cost very high. The system of accounting is not good, but the following costs of operation and maintenance to the city are approximately correct:

	per annum.
Coal cost	$4.800
Salaries	3.300
Carbon cost	150
Repairs, approximately	750
Depreciation, insurance and taxes, approximately	3 000
Total	$12 000
Received by water revenue	$6.000
Cash outlay by city	6 000

If the city were purchasing the same from a private corporation, on a basis of prevailing prices, the cost would be as follows:

127 fire hydrants	$5,080
100 street lights, at $75	7,500
Total	$12,580

Thus the approximate net saving to the tax-payers is $6,580 annually, besides the supplying of water at one of the lowest rates in the state. It is safe to say that the economical results accomplished in this plant are due to the saving on salaries and station costs, made possible by the combination of these two public service institutions.

A REMEDY FOR THE CHOKING OF SEWER PIPES BY TREE ROOTS.

By George Bowers, City Engineer, Lowell, Mass.

In the February number of MUNICIPAL ENGINEERING appears a letter from "Subscriber" in reference to the choking of pipe sewers by tree roots. He was told that the only way is "to have absolutely tight joints." This is true, but to get the ordinary mason or pipe layer to make absolutely tight joints is difficult. In the city of Lowell, Mass., are many elm trees standing between the sidewalk, and sewers, the roots of which have in a number of cases found their way into the main pipe sewers and into house connections. This has already necessitated the relaying of several sewers and more will have to be rebuilt in the future. Ring pipe was formerly used, the joints being made with mortar that was too moist for the purpose; the objection to moist mortar is that in setting it is liable to crack, making small openings into which the thread-like rootlets readily find their way, attracted by the moisture of the sewer. Three years ago the city began using deep socket pipe in place of ring or of standard pipe. With this new pipe we require the bell to be three inches deep for pipe twelve inches in diameter, the bell increasing in depth as the diameter of the pipe increases. The joints are made in the following manner: After having well centered the pipe jute packing is well pressed into the joints with a calking iron and the mortar is rammed in. The mortar is made of equal parts of cement and sand, mixed quite dry in order that the joints may be filled after the cement is set. This method of laying sewers should be applied to all house connections as well as to main sewers. I believe that in many cases where sewers have failed to do their work properly and the trouble has been attributed to other sources, an investigation would show the presence of tree roots in large quantities.

LIMITATION OF INDEBTEDNESS OF MUNICIPAL CORPORATIONS.

A REVIEW OF RECENT COURT DECISIONS.

By C. W. Tooke, A. M., LL. B.

It is a fundamental principle of the law of municipal corporations that in so far as they are not limited by positive legislative enactment, all powers may be exercised by them that are incidental and fairly within the scope of the powers expressly granted by the charter provisions. From the nature of the case, only general powers can be expressly conferred, and whatever powers are adjudged essential to the carrying out of the express provisions must necessarily be implied. But the power to borrow money is not regarded by the

weight of authority to be such an incidental power as to arise from implication. Taxation is the normal method of providing for the cost of city government, and while temporary indebtedness to be met out of the current revenues may be incurred, it is not to be implied that a city may incur permanent loans without the express authorization of the legislature. In the language of the supreme court of the United States:

> It does not belong, as a matter of course, to local governments to raise loans. Such governments are not created for any such purpose. Their powers are prescribed by their charters, and those charters provide the means for exercising the powers; and the creation of specific means excludes others. Indebtedness may be incurred to a limited extent in carrying out the objects of the incorporation. Evidence of such indebtedness may be given to the public creditors. But they must look to and rely on the legitimate mode of raising the funds for its payment. That mode is taxation. (Mayor *v.* Ray, 19 Wall. 475.)

The control over municipal indebtedness by the legislature proved, however, to be, of itself, ineffectual in keeping municipal corporations within a proper exercise of the powers conferred upon them by their charters and by general laws of incorporation. In the early part of the century not only were cities and villages given free rein in this respect, but the needs of such localities were so few that no abuse of their privileges was noted. Soon after the policy of the state in aiding internal improvements was abandoned, however, the legislatures, in response to the demand of the people, began to empower the local subdivisions to give aid to the many turnpike, canal and railroad companies that claimed their aid in the construction of the means of transportation. So rapidly did the indebtedness of the municipal corporations increase from 1830 to 1850 that it was deemed necessary to limit their powers in this respect by constitutional enactments. In 1851 the Ohio convention drafted the provision that the legislature should never authorize any county, city, town or township, by vote of its citizens or otherwise, to become a stockholder in, or loan its credit to or in aid of, any private corporation or association whatever. Iowa, in 1857, hit upon the additional expedient of providing a 5 per cent. limitation, based upon the last assessment for state and county taxes, an expedient that was subsequently adopted by a large number of our states which later came to deal with the same problems.

These percentage limitations were introduced before the question of municipal ownership of public service industries had become prominent, and their operation has been to check the extension of municipal enterprise in this direction. While the needs of our cities have increased with great rapidity, in many cases the limitation has been growing more and more stringent because of the under-assessment of real and personal property listed for taxation. It is not our purpose to inquire whether this restriction is a salutary one or not, but only to emphasize the fact that it was adopted before the present problem had arisen, and to point out a few principles of its application as shown by several recent decisions.

In the case of the Ætna Life Insurance Co. *v.* Lyon County (95 Fed. R. 325), all the owners of a series of bonds, amounting to $120,000, were parties to the suit. The evidence showed that, aside from the force of the Iowa limitation, forbidding the creation of indebtedness by municipalities of the state to an amount in excess of 5 per cent. of the value of the taxable

property therein, the bonds in question had been issued under due and proper authority of law, and that the county had received full value therefor. So that the question was narrowed down to the proposition whether the constitutional limitation prevented the granting of any relief to the plaintiffs. While it is generally held that all indebtedness contracted by a municipality, after the limitation has been reached, is void, the federal courts apply certain principles that tend to construe the general principle very strictly. In the case at hand the court applied the principle that although the bonds issued, together with the existing valid indebtedness, exceeded the limit of indebtedness fixed by the constitution, since a part of the prior existing indebtedness was paid from their proceeds, they were enforceable to the extent of the difference between the remaining prior indebtedness and the constitutional limit.

In Crebsy *v.* City of Lebanon (98 Fed. R. 549), in a mandamus proceeding under the Missouri statute to enforce the levy of a tax to pay for a judgment in favor of a contract debtor, the city set up the defense that the debt contracted was in excess of the amount allowed under the constitutional limitation. The contract in question was for the supply to the city of light by a company which had been regularly granted the right to erect a plant and furnish light for a period of twenty years. Previously a similar contract had been made with the same company for a supply of water. The works had been duly erected and water and light supplied and paid for by the city, until, in 1894 or 1895, the city defaulted in its payments. In granting the relief prayed for, Judge Philips refused to consider the plea of the city, on the ground that sufficient evidence had not been adduced to show that the city had in fact exceeded the constitutional limit of indebtedness. Where the city sets up such a claim, the burden rests with it to establish clearly all the facts necessary to establish such a defense. The court further held that, under the statute of Missouri which provides that, within the constitutional limit of taxation, the whole levy ordered by the court may be applied in satisfaction of a judgment debt, "except such amount as may be necessary to pay reasonable salaries allowed by law to the mayor, council, marshal, constable, attorney and a reasonable police force," the city may not avail itself of the defense that it has levied taxes up to the full constitutional limit, but has no surplus on hand, after paying the legitimate expenses of government, which can be applied on such debt, where, as in the case at bar, the city had expended money for purposes other than those enumerated in the statute.

It is, however, always a valid defense if the city can establish that the indebtedness in question has in fact exceeded the constitutional limit before the additional debt is contracted. Some of our states have gone farther and passed supplementary acts which establish lower limitations than those fixed in the constitution. In case such statutes leave with the board or officers issuing them the determination whether the bonds exceed such limit, a recital in the bonds themselves that the limit has not been exceeded will estop a municipality from setting up such a defense. But a general recital that the bonds have been issued in accordance with all the requirements of the law will not preclude the municipality issuing them from showing that the legal

limit was in fact exceeded, and the purchaser of such bonds takes them at his risk. Upon this state of facts it is the duty of the purchaser to make an examination to ascertain for himself whether the statutory limit has been reached. (Geer *v.* School District, 97 Fed. R. 732; Dixon Co. *v.* Field, 111 U. S. 83; Board *v.* Rollins & Sons, 173 U. S. 255.)

The most recent case setting forth the effect of the percentage limitation on the undertaking of public improvements by cities and villages is that of Windsor *v.* City of Des Moines (81 N. W. R. 476), passed down by the supreme court of Iowa at its January term. Prior to the year 1897 there had been in operation in the city of Des Moines three private electric light plants. In the early part of that year the city authorities concluded to construct a fourth plant at the expense of the city. It was realized by the mayor of the city that the constitutional limit of indebtedness had been reached, but it was hoped that some scheme could be found whereby to circumvent this obstruction. In accordance with plans carefully formulated, the board of public works published proposals for the construction of such works, and three separate bids were submitted by a certain company for the construction of the plant. Thereupon the mayor by proclamation called a special election to determine whether the citizens favored the establishment of a municipal electric lighting plant. Not to speak of technical defects in the mode of submitting the question to the people, the proposition was evidently favored by a large majority of the citizens. The contract was accordingly entered into by the city authorities with the company, but before anything was done, plaintiff commenced suit in equity asking for a decree canceling such contract and assailing the validity of the tax levied to meet the obligation of the contract, basing his contention mainly on the ground that thereby an indebtedness was created in excess of the constitutional limit.

By the terms of its contract with the city, the company agreed to furnish the materials and to construct the plant according to certain plans and specifications, to be completed and ready for occupancy on or before Jan. 1, 1898. The plant was then to be accepted by the city and a payment of $60,000 made on account of the construction thereof. The contractor was to operate the plant the first year and to furnish certain lights to the city, and at the end of the year, if the plant had been operated according to the terms of the agreement, the company was to receive a further payment of $25,000 on account of construction, and monthly, during the year, for lights furnished, the sum of $2,708.33. For the second year, the company was to operate the plant, receiving the same monthly payments for lights, and at the end of the year, $24,000 on account of construction. An option in the contract made it possible for the contractor to continue to operate the plant for an additional period of thirteen years. The city further contracted to issue warrants and to levy taxes for meeting the obligation incurred, and to take all measures essential to the carrying out of the terms of the contract.

The city thus made the attempt to evade the constitutional limitation by postponing the time when the obligations would become due, on the theory that no debt was thus created, but merely a contractural obligation which could only become a debt as the light was fur-

nished and the compensation earned. The court held, however, that while this argument might hold as to the ordinary expenses of the city, as the furnishing of light or water or of fire protection, it could not be applied to the construction of a plant for this purpose. Indeed, the principle had been fairly well settled before in some states, as in Iowa, that the sums to become due in the future on such a contract must all be taken into account in estimating the amount of the existing indebtedness of the city. But the court admits that the doctrine is different in certain other states, as in Indiana, Wisconsin and Massachusetts. The final ground for the maintenance of the doctrine of the court in this matter is that the adoption of any other doctrine would nullify the force of the constitutional provision. Whatever we may say as to the merits of the constitutional limitation, we must admit that the reasoning of the court in this case is not only sound, but clearly in accordance with the established precedents of that state.

THE QUESTION DEPARTMENT.

[By Charles Carroll Brown, M. Am. Soc. C. E., for MUNICIPAL ENGINEERING.]

QUESTIONS AS TO SEWER ASSESSMENTS.

The city has been divided into sewer districts, of which plans and specifications are on file with the city clerk. In fixing on a uniform tax of forty cents per lineal foot on each side of street for all assessable property along which a sewer is constructed, the question has arisen as to the legality of taxing lots abutting lengthwise on such sewer at the same rate per foot as those lots which are abutting endways on the sewer? In other words: If a lot 60 feet by 120 feet abuts with its side of 120 feet on such street in which a sewer is being built, and the other lots in the block are of same size but are abutting with their ends of only 60 feet on the same street on which the sewer is built, should the first mentioned lot be taxed at the rate of forty cents per lineal foot for the 120 feet the same as the other lots which front with only 60 feet? The general idea is that a lot abutting with its side on a sewer is not benefited more by such sewer than is the one which is abutting with its end.

We would be very thankful for some legal decision in above, and also what is the general rule in taxing property where sewer is constructed.

L. C. Hjorth,
City Engineer, Neenah, Wis.

Quite full discussions on these points will be found in the following numbers of MUNICIPAL ENGINEERING magazine: October, 1898, page 215; May, 1899, page 313; July, 1899, pages 32 and 33; August, 1899, page 97. Further discussion will be found in the editorial department of this number. In general, the principle upon which the assessments must be made is that of actual benefits. It is possible that the benefits are so distributed in some cases (including the differences in cost of connections on account of differences in distance of houses from the sewer) that the plan of assessment proposed would be equitable, but it is hardly probable that such a rule will fit every case. Frontage is a large factor in determining the amount of assessment and is the only thing taken into account in many cities. The recent Missouri decisions referred to in the July and August numbers prohibit the restriction of the determination of benefits to this one rule. Area of lot should also have some consideration, especially in the thickly-settled districts of the city. Value of property also enters in a general way, receiving its share of the tax

through the part of the payment for the sewer made from the city treasury. Boston tried to make part of the benefit depend on the amount of water used, but failed to convince the courts of the justice of this method. Omaha distributes the front-foot assessment over an area extending half way to the next street (or alley), reducing the amount of assessment rapidly back from the street line. This is usually equitable, but occasionally taxes for a part of the assessment a lot which receives no benefit. A rule to include all three of the factors mentioned should be formulated to suit the general conditions existing in the particular city. It may sometimes be necessary to modify such a rule for special cases, even when it is the best general rule that could be made. These exceptions must be made very seldom, and only on full consideration and with much difficulty, or the council or board will be overwhelmed with demands for exceptional treatment, based, perhaps, on valid grounds, but too trivial to receive attention.

SPECIFICATIONS FOR WORK OF STEAM ROAD ROLLERS.

(1) Where cedar block pavement is used, in bringing the earth, after excavating, to a proper degree of hardness, would you specify a roller of a certain weight or determine the hardness or density of earth-bed by the depth of impression made by the rim of a wheel of a loaded wagon passing over the bed after being rolled? Please explain best method in use.

(2) What work fills the same place in paving that "Sewerage," by Folwell, does in sewerage?

(3) Would you use sand or gravel under stone curb?

J. J. Smith, Grand Forks, N. D.

(1) The usual specification requires rolling until the surface is solid and to grade, depressions in the grade being filled with gravel and suitable earth as they appear before and during rolling. Soft spots which can not be solidified by the roller should be excavated and filled with gravel, or broken stone, or good dry earth. It is not easy to make a definite rule that will fit all cases, since some soils will require more rolling than others, and some will require a heavy roller while others will be best rolled with a light roller. Usual specifications as to weight of roller are 200 pounds per lineal inch of roller, 6 tons and 10 or 12 tons. The lighter roller is the most common for the class of work mentioned. A steam roller is best, as the horses do not then tear up the rolled surface with their hoofs, but is not always obtainable in small cities. Every small city should own one to use in repair and construction of its dirt and gravel streets as well as in preparing for pavements. A common specification for rolling asphalt is five or six hours of rolling on each 1,000 square yards of surface. A similar specification, time to be determined by trial, might be made for rolling the grade if necessary, to protect the engineer, he being given discretion to reduce the amount of rolling if he thinks best.

(2) Good books on paving are Byrne's "Highway Construction" ($5); Spalding's "Text-Book on Roads and Pavements" ($2); Rockwell's "Roads and Pavements in France" ($1.25). Spalding's is perhaps the book wanted. Any of these books can be supplied by MUNICIPAL ENGINEERING COMPANY.

(3) Gravel, not too coarse, will make the most satisfactory bed for stone curb. It should be tamped in on both sides of the stone to the level of the grade. If the soil is very wet some opportunity to drain the water out should be given at intervals. Some mixture of sand

with the gravel will not be objectionable, nor will all sand, if it is clean, and good gravel is not obtainable.

FLUSHING WITH WATER AS A MEANS OF CLEANING PAVED STREETS.

Is it dangerous to the durability of a brick, Belgian block or asphalt block pavement to flush it with a moderate-sized stream from a fire-plug?

I have flushed our streets by the use of a plug stream and spray nozzle attachment on two occasions, and from a sanitary point of view the streets were thoroughly cleansed, pleasing our citizens better than and at about the same cost as sweeping.

I have found that sweeping, though done by an up-to-date method, fails to drive out the dust, dirt and manure from the wide joints of the Belgian block, and, although the pavements have been thoroughly wetted by the sprinkler, yet the time which elapses between the sprinkling and sweeping, the heat of summer soon evaporates the moisture, so that by the time the sweeper passes over the work, clouds of dust are driven into all open doors and windows, with just cause of much complaint from the residents.

On the other hand I have devised a series of small spools or trucks for the saving and transportation of the hose over the rough pavements, also a special truck for the support of the nozzle, whereby the men can more easily control the flushing, and relieve themselves of the severe pulsations caused by the water passing the nozzle. I have proven by these experiments, to my satisfaction, that as far as sanitation is concerned I have attained my object, but on the other hand I do not wish to sacrifice the worth of the paving.

I am indebted to Mr. Joseph P. Phillips, city engineer of Scranton, Pa., for a print of spools or trucks used by him, and other information of value.

S. Cameron Corson,
Borough Engineer, Norristown, Pa.

The amount of damage done to the pavement by cleaning in the manner described depends upon several factors. The force with which the water strikes the pavement, the direction in which it strikes, and the amount of water, on the one hand, the character of the material of which the pavement is made, the number, size and form of joints, the filling used and method of putting it in, and even the character of the foundation, must be considered. In general, a sheet pavement can be thoroughly cleaned by a stream from hose without injury if the water can all be drained off. The force of the stream should not be too great. Where there are defective spots, it should be as light as possible. The nearer a block pavement approaches the surface of a sheet pavement the less the danger of injury by this method of cleaning. If the joints are thoroughly filled with an adhesive compound, a stream under low pressure will not do much injury, but sand filling will be washed out, and any foundation but one of concrete might be injured by the admission of too much water. Brick or some grades of granite, which are somewhat brittle and liable to be chipped by the action of the traffic, will deteriorate the most rapidly under this treatment, the broken bits with the joint filling being washed away by the force of the water. Any thorough process of cleaning will have the same effect, so that this is not an objection to the specific method under consideration. A stream of such force that the pulsations are severe enough to require the relief spoken of is too strong. The same effect can be produced, using no more water, but taking, perhaps, a little longer time, with much less danger of injury to the pavement.

THE BEST KIND OF RAIL FOR STREET RAILWAYS.

Which, in your opinion, is the most desirable rail for electric street railways, from the standpoint of the general public, the T-rail, the tram head girder or full groove rail? Yours,

James P. Edwards,
Houghton, Mich.

The general result of several discussions of this question in the American Society of Civil Engi-

neers, the American Society of Municipal Improvements, and elsewhere, seems to be an impression that the T-rail is not desirable in streets where there is any material traffic, unless there is a specially solid road-bed for the tracks, a good pavement which is wide enough so that it will be unnecessary to use the track for travel of other vehicles, and with better surface than that adjacent to the track, so that traffic will tend away from the tracks, and a special construction of the pavement next the track, like the newer work in Minneapolis, for example.

The side-bearing girder rail seems to be the most generally applicable form. In some cities where there are many varieties of wagons for many uses and thus varying in gauge, the tread is made as wide as possible so that all wagons if possible can use both rails if either is used. If streets are narrow this construction is quite necessary if there is a double track. An exception to this is found in such streets as Chambers street in New York, where the slight difficulty in leaving the track tends to make the wagons run often with wheels on one rail, thus causing a rut to wear under the other wheels. The enormous traffic in this street soon wears this rut so deep that it emphasizes the tendency to run in one line and the pavement is cut through. On streets with ordinary traffic the incipient rut is smoothed out as rapidly as it is formed, and the wear extends over a somewhat wider strip.

The full ground rail will not permit wagons to follow it with safety to the pavement, for wheels of different gauge will strike the pavement or the rails in different places, and some of them will wear the pavement rapidly in its most tender spot, next the rails, so that it will soon show serious need of repair. It is not a good rail, therefore, for narrow streets, where it is almost necessary to follow the rails. The ease with which vehicles can cross it, and the smooth junction with the paving possible with the best forms, make it the ideal rail for smooth, wide pavements, especially those with light vehicles.

Every rail is objectionable if the pavement is not kept in repair, but the side-bearing rail is probably the least objectionable under such circumstances, including the softer pavements, such as macadam.

The essential requirements are that the depth of the rail shall be from 6 to 9 inches, so that the rail shall be stiff, and the bed for ties shall be solid, so that they will not settle or work up.

EXPANSION OF AIR.

How much will air at zero expand when heated 10 degrees, 20 degrees and every 10 degrees up to 50? *Jas. M. Madden, Poughkeepsie, N. Y.*

Air expands uniformly for each degree of increase in temperature about 1-460 of its volume. The number of cubic feet in a pound of air at a given temperature can be determined by means of the formula

$$V = \frac{t + 460}{40}$$

in which V is the number of cubic feet in a pound of air and t is its temperature in degrees Fahrenheit. Substitute 10, 20, 30, 40, 50, etc., for t and a comparison of the volumes will give the ratio per degree of increase in temperature given above.

THE BEST SYSTEM OF SEWERAGE FOR TOWNS.

Will you please refer me to the best sewerage system and method of construction for a town of from three to four thousand inhabitants, and greatly oblige,

P. N. Gillham, Luverne, Minn.

The best method for a given town can not be determined, certainly, without a careful, expert study of the conditions in the particular locality. It is probable that the separate system, using pipe sewers, will be most satisfactory when cost and service are taken into consideration, because that system fits the most towns of the size mentioned, but this town may be an exception to the general rule, on account of peculiar local requirements. Folwell's "Sewerage" ($3), gives a discussion of the subject which will be of interest. Staley & Pierson's "Separate System of Sewerage" gives the arguments in favor of that system at length ($3). MUNICIPAL ENGINEERING COMPANY can supply the books.

FRICTION AND PRESSURE IN WATER MAINS.

I would like to get a book which gives the rules governing friction and pressure in water mains, and by which to determine size of mains for given conditions, height of fire streams, etc.

L. L. Loveland,
Secretary Water Co., Carbondale, Pa.

Coffin's "Graphical Solution of Hydraulic Problems" ($2.50) and Weston's "Friction of Water in Pipes" ($1.50) give full tables and diagrams for solving problems of this sort. Mr. Coffin's tables of fire streams are the result of his experiments, and those in the two books on the flow of water in pipes are based on different formulæ but giving results very nearly the same. Folwell's "Water Supply Engineering" ($4) gives formulæ and the principles on which they are based, with some tables and diagrams. Fanning's "Water Supply Engineering" ($5) is also valuable, but does not answer some questions of the sort as quickly and easily as the later books.

FLOORS FOR FIRE DEPARTMENT STABLES.

In our city halls we keep our fire department horses. Under the stalls the furnaces are located, and it causes a very bad smell in the rooms above. We have tried several floors and have failed to stop the smell. Can you tell what kind of floor to use? *J. F. B., Neenah, Wis.*

It is absolutely essential that all horse droppings, urine, remains of feed and other litter be removed *instantly* from the stalls and the building. No floor will be of any value in preventing odors if this essential is neglected. Feed boxes, floors and walls must, therefore, be of form and material to permit easy sweeping and flushing with water, and prevent the accumulation of dust or refuse in corners. Floors must be of non-absorbent material and sides of stall of the same or thoroughly covered with metal or other non-absorbent as far as any liquid is likely to reach.

A concrete floor is suggested, or one of wood, creosoted and filled with tar. It may be desirable to cover this with a wearing surface of some asphalt or tar mixture, to insure that it will shed water, and for the comfort of the horses. Ventilation will also be essential. In some cases the room is ventilated through the floor, the induced draft being sufficient to draw most of the odors away as soon as formed. A tight ceiling and hoods over the stalls to draw to a ventilating stack with draft should be easy to construct, and not expensive, and will remove practically all the remaining odors. All three of these are

essential, viz., instant removal of refuse, non-absorbent floor and sides of stalls, thorough ventilation through stack, if all traces must be removed. Anything less will be satisfactory to a degree only.

[By A. D. Thompson, C. E., for MUNICIPAL ENGINEERING.]

INFORMATION ABOUT BRICK PAVING.

What is the best treatise on brick street paving? I want something that will give the work in detail; the laying-out of the work, rise of curbing, foundation, etc.; also, a chapter on the kinds of brick. Can you give me the names and addresses of several good paving brick manufacturers?
J. S. Haines, Dowagiac, Mich.

None of the books on pavements give a very full and complete discussion of the latest methods in the construction of brick pavements. Descriptions of such methods are contained in "Brick Pavements and Paving Brick," by Chas. P. Chase ($1); "Highway Construction," by A. F. Byrne ($5), and "A Text Book on Roads and Pavements," by F. P. Spalding ($2).

Much of the best information upon this question is contained in the various articles published in MUNICIPAL ENGINEERING. In volumes 9 and 10 of this magazine there is a series of articles, entitled "Brick Paving from Start to Finish," by M. Nicholson, C. E., which gives a very complete, detailed description of brick pavement construction, from the preparation of the plans and specifications, through the various construction processes, to the completion of the pavement. The first article of the series is contained in volume 9 and deals with the preparatory work. The remaining three articles are in volume 10, and deal with the foundation, the qualities of brick and paving next to street railway tracks.

From the advertising columns of MUNICIPAL ENGINEERING, you can obtain the addresses of a large number of reliable manufacturers of the best paving brick in the United States.

COMMENT ON CURRENT TOPICS.

Sewer Assessments.

A correspondent of MUNICIPAL ENGINEERING gives a statement of sewer plans and of a proposed assessment to pay for its cost by frontage assessment. The length of the lots is about twice the width. The sewers run along the short sides of most of the lots, along the long side of some and along both sides of a few. So far as appears from the map, there is no difference in benefit to lots from the sewers. If the cost is assessed in proportion to frontage, the first lots mentioned would pay $1 to the second $2 and the third $3. In the light of the recent Ohio and Missouri decisions, this method would be illegal under the conditions given, since the assessments would not be proportional to the benefits received. It would be quite possible for a part of a lot to escape assessment altogether, if the sewers were not all built at the same time. In the case of the writer's own paving assessment this is true. Lot 6, facing L street, lies behind and adjoining lots 1 and 2, facing G street. The writer owns

lot 2 and the back half of lot 6. His neighbor, on the corner of L and G streets, owns lot one and the front half of lot 6. G street has been paved and lots 1 and 2 have been assessed for the pavement. When L street is paved lot 1 and the front half of lot 6, abutting on the street, will be assessed for the pavement. The back half of lot 6 will thus escape assessment. If the division of lot 6 had been made after the pavement of L street, it would have borne its share of the tax on that street. It is true that if the lots had been originally laid out in the form in which they are now owned, the assessments would have been exactly the same as they now are. Supposing, however, that the improvements had been sewers, lot 2 would pay $1, the back half of lot 6 nothing, lot 1 would pay $3, and the front half of lot 6 $1, the proportions of the lots being as stated above. The writer therefore pays $1 to his neighbor's $4 for practically the same service. The neighbor would have the advantage of a shorter house connection except for the fact that L street sewer was not built promptly and he made his connection with the G street sewer.

The following method of removing this inequality of assessments was adopted in one large system, where the law required assessments in proportion to frontage upon the sewer line for local sewer, after a certain amount had been taken out and assessed upon the area of the entire sewer district as the cost of the outlet. The plan for the main sewer stated the location and size of all the lateral sewers; all house connections and laterals were carried to the curb line on account of pavements; the laterals were then extended along the side of the lot abutting on the main sewer, so that when the whole lateral sewer was afterwards built, this lot would not receive a second assessment. Under the method of bidding required by the law the cost of all these house connections and laterals was included in the bid per lineal foot of main sewer. The cost of the main sewer was increased slightly, but each lot thus paid but a single assessment for local sewer, and complaints and contests over the payment of a second local sewer assessment were shut off.

Assessments according to area of abutting lots are usually more likely to be correct than assessments according to frontage, especially if the portion of the cost of the main sewer properly chargeable to its service as an outlet is distributed over the entire sewerage district. In the case under discussion all the lots would pay equal assessments, provided the entire system were constructed at the same time. If the laterals were constructed later, under a different contract, the corner lots having sewers on two sides would pay two assessments, unless some such plan as that described for building a few feet of the lateral under the contract for the main sewer were adopted.

A plan for assessing the cost of

sewers according to the size of connection by fees paid when connection is made was described in an article on "Assessments for Sewers and Water Mains," on page 215 of this magazine for October, 1898. The article also mentions the system of assessment in Brookline, Mass., part by frontage, part by area, and part by general tax; and in Brockton, Mass., part by frontage, part by area, part by amount of water used (rental), and part by general tax. Boston tried to assess the maintenance of sewers upon the property served as a rental charge, part by tax on valuation and part in proportion to water used, but this has also been decided to be unconstitutional.

No general rule will suit every case that may arise in a system. It is advisable, however, to adopt some general rule, based on the most equitable combination of frontage, area, valuation and amount of use which can be devised upon careful study of the local conditions. The use of area as the principal base will be found most generally satisfactory.

The decisions mentioned, if sustained by the highest courts, will probably cause legislators to look more carefully into the constitutional basis for proposed systems of assessment, but they will not interfere seriously with most of the systems now in use. They will give an impetus to the complaints of those who have been unjustly assessed, and at the same time a disposition to the authorities having the assessments in charge to review and correct such inequalities of assessment without the trouble and expense of suits at law.

Methods of Street Cleaning. A question by a correspondent of MUNICIPAL ENGINEERING suggests a discussion of methods of street cleaning a little more extended than is desirable in our Question Department. A pavement is cleaned for two principal reasons—to preserve the pavement and to promote the comfort and health of the residents on and users of the street. For sanitary purposes the most thorough cleaning is desired. This is undoubtedly secured by the proper use of plenty of water applied with considerable force. Very few cities are so fortunate as to have enough water to use it in this way. If water costs nothing the method is inexpensive so far as getting the dirt off the street is concerned. Catch-basins must be provided, however, for the street refuse will soon clog sewers, and there is seldom place on the surface alongside the street to deposit it. The frequent expense of cleaning these basins must be considered in comparing the cost of different methods. If water must be pumped or purchased by a company, or if additional storage capacity must be furnished, the total cost of the water method described is too great for general use. The European method of applying water from sprinkling carts and scrubbing the street requires much less water but more manual labor. Where labor

is cheap this method is less expensive than the other and it is applicable to almost any city conditions of water supply. It would probably be too expensive for application in this country. The scrubbing brush is applicable only to sheet pavements and to new and smooth block pavements. The amount and force of the stream of water from hydrant must be modified to suit the nature and condition of the pavement. Both methods are applicable in so few cases in this country that there are no figures of actual cost obtainable for any extensive application of them.

For smooth pavements the pneumatic street sweeper is probably the next in order from a sanitary standpoint. When supplemented by men with scrapers and small brooms during the day, the results are quite as satisfactory as those with water not so supplemented. The bids for street sweeping in Indianapolis, as given in our news columns each year, give the comparisons of cost and the variations with the changes in conditions and requirements.

The broom sweeper is undoubtedly more generally applicable, as it can be used on asphalt, brick, stone, unless too rough, and even on the best macadam pavements. It does not clean asphalt as thoroughly as water or the pneumatic sweeper can, leaving a small amount of fine dust to be blown about by the wind. It breaks off and carries away loose bits of brick or stone from block pavements, like the hydrant stream of water, thus hastening the wear of such pavements somewhat. It requires supplementing by hand work upon rough stone pavements, but when efficiency and cost are both considered it is of most general application.

All hand work is strongly advocated by a few who have been able to secure good results at fairly reasonable prices, but the general verdict seems to be that some machine method for a general cleaning at night, supplemented by some hand work during the day, is more economical and quite as satisfactory.

Conditions of pavement, ease of disposal, methods of payment, character of supervision differ so much that only general statements of relative cost of the various methods are possible. Prices in specific cases appear frequently in our pages, as well as collections and comparisons of results. Mr. Rosewater presents such a collection on page 201 of our issue for last month.

Asphalt, macadam and wood pavements are most durable if kept clean. Stone and brick pavements may be protected from wear if kept covered with a proper thickness of dirt. The dirt is very likely, however, to be removed in spots, thus causing uneven wear, which causes progressively rapid deterioration of the pavement. Unless the conditions are such, therefore, that the dirt covering remains undisturbed,

the durability of block pavements is also increased by keeping them clean.

State Taxes for Highways. The state of New York made a small appropriation for construction of highways and the state engineer has issued bulletins giving cross-sections and specifications and directions for maintenance. He also reports on the expenditures made and gives an example of the operation of the law to show the distribution of the cost. A road in Oneida county, 2¾ miles long, cost $14,686 or $5,340 a mile. Of this amount the property benefited pays 15 per cent., about $400 a mile on each side of the road. The county pays 35 per cent., making 6¾ cents on $1,000 valuation, the county tax for the road. The state pays 50 per cent., which makes a state tax of 1 cent on $1,000 valuation. Oneida county, aside from the property directly benefited, thus pays a total tax of 7¾ cents on $1,000 for the 2¾ miles of road. The 450 miles of road petitioned for would require with the same average cost a state tax of $1.64 on $1,000 to pay the state's half, which would raise nearly $2,500,000. It is evident that the state will not be able to aid the building of roads at a very fast rate if the present proportion is continued. In the meantime the counties which receive no benefit will object on this account. It is hardly possible under the present conditions of ratios of payment and small appropriations for the state to do more than construct bits of road in the various counties as examples of proper construction. The counties must expect to do most of the work without aid from the state. Thus last year the state appropriated $50,000, which paid its share of the cost of about 15 miles of road.

The percentages to be assessed against the state, the county, the town or township and the district directly benefited vary with the conditions of the state, and also vary in various sections of a state so diversified as the state of New York. It seems necessary, however, to make the proportion to be paid by the state less and to add a proportion for the township if the construction of roads is to proceed at the joint expense at a very rapid rate. Too great a proportion laid on the state will delay the construction of roads on account of small appropriations just as too great a proportion laid on the benefited property and the township will delay by the refusal of the taxpayers to put so large a burden on themselves. Thorough study of conditions, county by county, must precede fixing of all the proportions.

Stand-Pipe Failure. Full details from an engineer's point of view are not yet at hand regarding the failure of the stand-pipe at Elgin, Ill., March 14. The estimate in the newspaper reports that there had been 50 tons of ice in the

tank, and the fact that the pressure gauge showed the tank to be seven-eighths full, suggest the probability that the collapse occurred from carelessness in determining the presence of the ice and in permitting the water in the standpipe to be drawn down, leaving a vacant space below the ice. The weight of the ice, aided perhaps by the pressure of the atmosphere on account of a partial vacuum between the ice and the water, caused the ice to slide or drop down the stand-pipe and to strike the water with enough energy to burst the stand-pipe below the ice and cause its collapse. A fall of 50 tons even two feet would produce 200,000 foot pounds of energy.

This may have been increased by some atmospheric pressure at the beginning of the motion, but was reduced by friction on the side of the pipe. The shock by the sudden stoppage of the motion when the ice reached the water was more than the steel in a tank can bear, and collapse followed naturally. The accident happened so suddenly, and the ratio of area of outlet pipe to area of cross-section of standpipe is so small, that the pressure was relieved by the bursting of the standpipe before it could be transmitted in very dangerous amount to the pipes in the distribution system. A large increase in pressure followed by a sudden decrease by loss of head on collapse of standpipe should show on registering pressure gauges connected with the system, and would be evidence that this is a good explanation of the cause of failure.

Occasionally a stand-pipe fails in this manner. If special precautions are not taken to prevent freezing of water in the stand-pipe this accident is liable to happen when the pumps are stopped for a time or there is a sudden draft on account of a fire. In continued cold weather close attention must therefore be paid to the condition of the water in the stand-pipe.

Removing Water Pipe. Correspondents who have made inquiry as to methods of unjointing cast-iron water pipe when taking it up will be interested in the work of a contractor, Fitzpatrick, of Wichita, Kan., who took up over 17,000 feet of 4, 6, 8 and 10-inch pipe in 17 days with 25 men, including trenching and back filling. Fires were built under the joints of the two larger sizes which were raised enough to give the necessary room. The section of pipe was then worked up and down until the joint loosened and could be pulled apart. For the smaller sizes the pipe joints are heated but little and the pipes were forced apart by jack-screws acting against clamps surrounding the pipe and abutting against the bell of the pipe to be removed and the bell of the next pipe at the joint to be pulled apart.

Standard Tests for Paving Brick. The vexed problem of devising satisfactory and reliable methods suitable for gen-

eral adoption for determining the qualities of bricks for paving purposes appears to be in a fair way of solution through the efforts of the manufacturers of this paving material. Most municipalities where brick paving is in use specify test requirements that are peculiar to each locality, thus imposing a wide variety of conditions which in some instances are unreasonable and conflicting and in a few cases impossible. It has been the desire of the engineers and manufacturers interested to secure reasonable, fair and specific demands as to quality and to reduce the test methods to the least possible number operated in an economical, simple manner for uniform application and universal adoption.

Innumerable tests have been made during the last ten years under almost every conceivable condition, and there has resulted the accumulation of an enormous mass of experimental data of slight general value since the methods employed varied with each locality, thus offering no opportunity for a comparison or corroboration of the principles claimed to be established. There were a few individuals, however, sufficiently interested to undertake systematic experiments, and enough of such work was done to develop the general principles involved, expose numerous false theories and indicate a specific line of investigation necessary to the development of a satisfactory solution of the problem. The critical detailed examination of the test methods in use, and of the data giving results of such work, together with the conduct of systematic and extended experiments, required more time, talent and expense than could be devoted to such purposes by any individual or technical society interested.

In 1895 this question was taken up by the National Brick Manufacturers' Association, and for two years investigation and experiments were made under the direction of this society by some of the ablest men in the United States. A standard method for conducting tests of paving brick was adopted in 1897. The recommendations at that time were based upon an investigation of all the reliable data on the subject, as well as the information derived from two years of thorough experiments, and this standard has been adopted by numerous municipalities. The association did not stop with these results, but continued the study of the subject under direction of experts, at considerable expense, and gave thorough attention to the criticisms presented. During the past two years there have been three prominent methods for conducting the abrasion test, which is the most important of the series presented for commendation. A special committee of this society, on technical investigation, composed of manufacturers, engineers and professors, has been operating during the last year to determine, if possible, the best method for conducting such tests. The recommendations of this com-

mittee were presented to the association at the meeting in February, and a new standard for conducting the abrasion tests was adopted, while the committee will continue investigations to devise a better and more accurate method for determining the relative difference of paving brick.

The abrasion test recently adopted is based upon the best practices and conforms to the practical results of the most reliable experiments, and more nearly approaches a satisfactory standard than any of the others proposed. The association deserves the highest commendation for the impartial manner in which the investigations have been conducted, and for the progressive spirit manifested in the endeavor to place this matter upon a business basis. Every effort, regardless of expense, has been exerted to bring this troublesome question to a practical and definite condition which would expose all the defects of the product in a certain and simple manner.

CURRENT INFORMATION.

Another Decision Adverse to the Barrett Law.

The Barrett law was again declared unconstitutional in an opinion at Indianapolis, March 22, by Judge Baker of the federal court. The decision was rendered in the case of James Charles against the city of Marion and the Warren-Scharf Asphalt Paving company. A restraining order was granted some time ago against the defendants enjoining them from proceeding with the improvement. The plaintiff proceeded on the theory that the assessment against his property, which has a frontage of 1,800 feet, would be made on the basis of front feet and not according to the benefits to be conferred. Judge Baker holds that the complaint states a good cause of action, and that the Barrett law is unconstitutional in that it provides for the taking of private property for public uses without adequate compensation, and without due process of law.

Judge Baker, in an explanatory statement, says his ruling applies to the improvements that may hereafter be made under that law, rather than to those already made.

It also applies to the property-owner who protests against making improvements under that law, rather than to the property-owner who stands idly by and allows the work to proceed without making an objection.

Contracts that have been made under the law, carried out and the work paid for in whole or in part, are still valid, he says. Property owners who have partly paid for improved sidewalks and streets along their property will have to continue the payments just as if Judge Baker had not made his ruling.

"The fellow who has stood by and seen the improvement along his property carried out without saying a word in objection to the proceeding, is out in the cold," Judge Baker says. "If a man sees that his property is to be benefited by the improvement to a degree that equals the cost, or greater than the cost of making the improvement, he would hardly object to the work going on. But if he sees that the cost of the work is going to be greater than the benefit he will derive from it, he will hardly keep silent. If he warns the contractor, or the one promoting the work, that the improvement will be carried out at his own peril and that he will fight the matter in the courts, then that man is entitled to the relief that the ruling of the court sets out. In the language of the boys on the street, 'it's a cold day' when a man can blow both hot and cold on the improvement question. He is either for it or against it, and can show himself to be in favor by keeping still and allowing the work to proceed. After the work is completed it is too late for him to raise objection on the plea that the cost has been greater than the benefits. If no

objection is made to an improvement being carried out, then the work can progress just as if the Barrett law were valid."

"If a man has paid for his street improvements and finds that his costs are greater than the benefits, what is his position under the rulings?" Judge Baker was asked.

"The legislature has the power to devise a plan for making collection that will equalize the cost of old improvements and the benefits. If a man's lot is not benefited as much as he has been assessed, the legislature has the power to make that man's assessment equal only to the benefits. Then, if this assessment does not come up to the real cost, the difference between what the man should pay and the real cost of the street should come out of the city treasury.

"The ruling of the court does not, in any way, affect the bonds that have been issued in making improvements under the Barrett law. Property owners who have agreed to meet these bonds will have them to pay."

Municipal Indebtedness for Water Works.

Judge Buckingham of Franklin, Ind., has decided that a municipal corporation cannot buy a water plant subject to a bonded indebtedness when that bonded indebtedness is in excess of the city's 2 per cent. constitutional limit of indebtedness. It cannot escape the binding force of the constitutional provision by not assuming the mortgage indebtedness and buying the property merely subject to it. The decision was rendered in the case of Blizzard vs. the common council of Franklin, in which the petitioners asked for an injunction preventing the city from buying the plant of the Franklin Water, Light and Power company. The city agreed to take $5,000 stock in the company and the plant was to be turned over to the city. There was a bonded indebtedness on the plant, secured by mortgage, of $95,000, making the total cost to the city $100,000. The city was already in debt about $40,000 and the 2 per cent. limit was only about $45,000. The company claimed that the city was buying subject to the indebtedness and that the plant alone stood for the debt, the city having no personal ability. A temporary injunction was filed in July, 1899, and the present ruling makes this permanent until such time as the debt will be reduced below the 2 per cent. limit.

Road Construction in New Jersey.

The sixth annual report of Henry I. Budd, commissioner of public roads in New Jersey, says that the "State aid" law was amended during the year so as to increase the annual appropriation by the State for road construction from $100,000 to $150,000, and that this increase has made possible the construction of an increased mileage as compared with previous years. The total mileage built since the passage of the "State aid" law is about 440, at a cost of about $2,147,000, making the cost per mile about $4,880. The portion of the cost paid by the state was $715,826.06. Oyster shells have been used in the construction of some of the roads in this state. The Mullion river road, in Burlington county, is built of gravel and oyster shells. A 6-inch layer of gravel was first laid and rolled; this was covered with a 6-inch layer of oyster shells and then a 2-inch layer of gravel. This top layer of gravel has proved a great protection to the shells from the heavy tides and strong winds that sweep over these meadows. The gravel for this road cost 45 cents per cubic yard and the shells cost 9 cents per bushel. The total cost of 1¾ miles of this road was $5,447.21. Another road built of oyster shells is in Salem county. This is 10 feet wide and 6 inches thick, the shells being placed 12 inches deep and rolled to 6 inches. One hundred thousand bushels of shells were used. This road is 2.17 miles long and cost $5,179.76.

A gravel road built in Gloucester county cost nearly as much as stone roads in some counties. This road is 14 feet wide; the gravel was placed to a depth of 12 inches and was rolled to 8 inches. The soil through which this road passes is sandy loam with the exception of two miles which is heavy clay. The subsoil was difficult to drain. The maximum grade was reduced from 5.05 to 2.25 per cent. One and one-half miles of this road were completed during the year at a cost of $4,852.22, the high cost being due to the heavy grades and the scarcity of gravel beds. Another road built of two kinds of local gravel is in Monmouth county. This varies in width from 14 to 20 feet and is 6 and 7 inches thick. The material used consisted of a mixture of clay gravel and a gravel rich in stone, making an apparent hard surface for all kinds of wear and weather. The price per cubic yard for the compacted gravel was 7½ cents, and the total cost of the road, 2½ miles in length, was $5,270.12.

The use of loam as a binder is not advocated by Mr. Budd, who says:

"In the composition of our roadbeds in all specifications prepared by the state, believing that a better and more permanent road will result from the sole use of stone, we have aimed to keep out of the roadbed

all material except stone and screenings, and have mainly succeeded in so doing in most of the southern counties of the state. In the northern counties, where they have been building for a greater number of years, the engineers are warm advocates for and still insist upon the use of more or less loam as a binder to the stone. The use of dirt of various kinds may not be detrimental if applied in very small quantities, as the stones more quickly come to a repose than where it is not used, and thus saves the contractor much time; but when they are allowed to use small quantities it frequently results through carelessness of workmen or otherwise that too much is placed in the heart of the road, making a filler of it instead of a binder; consequently, in wet weather it absorbs moisture, softens the roadbed and allows movement of the stone until traffic drives it to the surface and makes a surface of mud in the place of what should be stone. We believe there is no absolutely certain way to obtain a perfectly pure and solid stone bed except by the application of only stone binder; but as, according to the law, the freeholders and their engineers can prepare the specifications, we are in a measure forced to accede to their requests. As the counties will be responsible for the maintenance of the roads and as the freeholders so thoroughly believe they can better construct with the use of dirt binder, we have not withheld our signatures from specifications so prepared. Building material to produce the best results should be equal in hardness and toughness with the road stone; the best results are, therefore, obtained by using screenings or spalls from the broken stone used. Coarse sand or gravel can sometimes be used with impunity as a binder, but the wisdom of using loam or clay is very much questioned. When the latter material is used for a binder the road is apt to become very dusty in dry weather, and sticky, muddy and rutty in wet weather. We have educated several of the governing bodies of our counties to believe they will obtain more lasting results by the use of only stone screenings for binder, and hope in time to see the practice adopted by all the counties of the state."

Regarding the question of rolling, Mr. Budd says that rollers drawn by horses are not satisfactory for compacting broken stone or gravel roads. They are expensive to use and if the weight exceeds five tons they are not used on steep grades.

A 5-ton horse roller has a 5-foot face and if the contact with the surface of the street is 1 inch wide the pressure per square inch is 167 pounds. The hoofs of the horses displace the loose material which it is desired to roll and the weight exerted by one horse is as great and sometimes greater than that exerted by the roller. With a steam roller the pressure varies from 400 to 700 pounds per square inch. In operation the steam roller moves equally well either backward or forward and no time is lost in turning at each end of a section as is the case with a horse roller. It will also do good work on a grade of 16 per cent. If the cost of operation is taken into consideration the result is very much in favor of the steam roller. While its first cost is much more than that of a horse roller, its cost of operation is given as about $4 per day less; if in use 150 days in a year this amounts to $600.

Mr. Budd considered rutting, which is more apt to occur in wet weather, largely the result of using a soft binder between the stones. He thinks it will be overcome in a great measure when broad tires become the rule. To prevent raveling, which occurs in extremely dry weather, he has resorted to various plans with a certain measure of success. Where wetting can be practiced daily the roads maintain their integrity without much trouble. Where this is too expensive the smoothness of the pavement has been retained by the application of loamy gravel in dry weather and sand in wet weather. Each of these materials has contributed largely, in several counties, to maintain a smooth surface and as their utility is made manifest it is expected they will be more generally used. They take the water from the surface of the road and can generally be cheaply applied as, in most cases, they exist quite near the roads. Their use has become almost general in the southern counties of the state.

"Good roads are the result of a repair system where every defect is promptly corrected before it has time to cause serious damage. Many good roads soon become rutted and raveled from neglect to promptly and properly repair them. All roads should have constant attention. If a hollow or rut is formed, it should be filled at once with broken stone and wet and rolled. The feet of the horses loosen the stones and the wedge-like action of the narrow tires repeatedly passing in one track produces ruts in which water collects and softens the roadbed. Also in dry weather the cohesive power of the stone dust is destroyed, allowing it to be blown from the roadbed by the wind. The ordinary remedy for the last evil would be frequent watering. A small amount of water frequently administered destroys the tendency to ravel by increasing the binding power of the stone dust."

Mr. Budd does not advocate the building of gravel roads by the state, except in poorly settled communities and in farming or pine districts where gravel is abundant and the source of the supply is near to the roadbed. Some of the old gravel roads that are almost perfect in summer are almost impassible at times in winter. A number of these have been regraded and covered with stone, making satisfactory roads.

Regarding gravel roads on clay foundations, he says:

"Roads constructed over clay soils should

have at least 6 inches of coarse gravel mixed with the clay, so that, under the weight of the traffic, the stones would be consolidated so completely with the clay, they would prevent the surface water from percolating through and softening it. Before placing the gravel upon any road great care should be exercised to bring the roadbed to a proper grade, eradicating all ruts, mud holes or depressions. A good, even, regular, solid foundation should be even more completely obtained than where stone is used, and to properly place the gravel it should be put in layers and each layer thoroughly rolled and mixed; where it is too dry to properly consolidate, water should be used. I have seen a few gravel roads that are almost as hard as stone, but they are principally those where natural conditions have unwittingly entered to produce the proper combinations; but the majority of these roads present no such conditions. Therefore, extreme care must be continually exercised in their construction in order that art can assist in forming perfect roadbeds."

Mr. Budd does not believe that good, strong roads depend on the thickness. When the bottom is good a thin road can be made to perform as effective service as a thick one.

Study of Landscape Architecture.

The Lawrence Scientific School, Harvard University, the first American school to give a special four-year course of study in landscape architecture, has definitely planned the course. Instruction in the theory of design will begin in the first year, with historical and technical courses, followed by a special course in the second year on the history and principles of landscape design, consisting of lectures, supplemented by collateral reading, conferences and exercises in drawing illustrations of the lectures. This special course will be supplemented by a general course upon the principles of design in the fine arts and by a course in elementary architectural design. The latter, which is a second year course for students of architecture, will be modified to meet the needs of the landscape students, and stress will be laid upon the general arrangements of buildings, upon the treatment of axial arrangements and symmetry in design and upon the grouping of masses, rather than upon architectural detail. Successive courses in landscape design, including occasional lectures, but consisting chiefly of the actual solution of problems of design by the students under the guidance and criticism of the instructors, will be given during the third and fourth terms. The course is under the general direction of Frederick Law Olmsted, jr., assisted by Arthur A. Shurtleff, with Benjamin M. Watson in charge of the special work in horticulture. Their teaching will be supplemented by instruction under such specialists as George L. Goodale, Charles H. Moore, N. S. Shaler, H. Langford Warren, William E. McClintock and others.

New Paving Specifications in San Francisco.

The Merchants' Association of San Francisco, Cal., has suggested to the board of public works the advisability of revising the present specifications so that streets paved with material that has been tested and proven a success in other cities may be accepted. L. M. King, the association's superintendent, visited the Eastern cities some time ago with a view to obtaining data on the subject, and on the strength of Mr. King's observations the following ideas and suggestions have been given to the board of public works:

First—That there are in use in Eastern cities several pavements not in use in San Francisco and that these pavements have been thoroughly tested and proven satisfactory.

Second—That in cities where these pavements are used the pavements in general are much superior to the pavements in San Francisco at present.

Third—That on heavily traveled streets the stone block pavements are now almost universally laid on concrete foundations and the joints grouted with asphaltic compositions and that on streets subjected to extra heavy traffic such pavements are generally used in preference to all others.

Fourth—That in addition to the above pavement asphalt and vitrified brick are the pavements in most general use and that both of these pavements have been long used and thoroughly tested and found satisfactory.

Fifth—That among all the pavements in use asphalt is the one most generally used when new pavements are laid, except on streets having too much grade or subjected to extra heavy draying.

Sixth—That for business streets or other streets subjected to much traffic and requiring a smooth and noiseless pavement asphalt is much superior to the bituminous rock pavements used in San Francisco.

Seventh—That for streets requiring a smooth pavement, but not an entirely noiseless one, and not subjected to heavy draying, vitrified brick on a concrete foundation is one of the most desirable pavements.

Eighth—While modern wooden block pavements are not in general use in the principal Eastern cities inspected, asphalt and vitrified brick being preferred, our information is that such pavements when properly laid are being successfully used in Southern cities, and it is a well-known fact that they are largely used in Paris, London and other European cities. Such pavements are noiseless and non-slippery and therefore desirable in some locations. They require, however, great care in lay-

ing. We believe, however, that if citizens desire these pavements they should be permitted to lay them, provided they are laid under guarantees of not less than ten years.

The association urges that in the preparation of new specfications they shall include asphalt, vitrified brick, small basalt blocks and wooden blocks on concrete foundations, and that all of these pavements when laid on accepted streets shall be guaranteed by the contractors for ten years and suitable bonds be given for security.

For the Preservation of the Palisades.

A bill passed by the New Jersey legislature, March 20, authorizes the appointment by the governor of a committee of ten persons, to be known as the commissioners of the Palisades. These commissioners shall have power to condemn lands and take other steps necessary for the preservation of the tall cliffs and the conversion of the lands into a park, in conjunction with the authorities of New York.

Breaking of a Light and Water Company's Contract.

A decision was rendered by Judge S. D. Read, March 17, in the suit of the Lake Charles Ice, Light and Water Works company vs. the city of Lake Charles, La. The opinion was in favor of the city on the plea of estoppel and on the merits of the case. The suit involved the sum of $15,500 and franchises worth $100,000. The controversy over the electric lights and water supply of the city caused the breaking of the new town charter, and the limits were cut down to those defined in the charter of 1869. The light and water company sued for pay for services rendered under contracts given it when the city limits were extended. The city's attorneys maintained that the city government at the time the contracts were made was not legally constituted to enter into contracts. There has been an appeal from the decision to the supreme court.

Rights of Contractors for City Improvements.

A decision was handed down March 13 by Judge A. J. Vinje in the suit of Nichols vs. the city of Superior, Wis., that was favorable to the city. The suit grew out of a paving and sewer contract which the city had with Forestal Bros., contractors. The Forestal Bros. sold their rights in certain city contracts to the West Superior bank, which institution prior to its downfall, assigned the claims to L. A. Nichols, secretary of the school board. The city declined later on to pay the amount Mr. Nichols claimed, about $30,000, alleging that Forestal Bros. had failed to perform their contracts as to paving and sewerage, and that, moreover, the city had previously paid them more than they had really earned. The plaintiff held that the city had no right to offset losses on certain contracts with profits Forestal Bros. might have made on other city contracts when the contractor's claims became due after the assignment. The city, on the other hand, held that the firm had no right to assign its contracts, without the written consent of the city. Judge Vinje decided that the city need not pay the $30,000 sued for. The case will probably be carried to the Supreme court.

The Rate to Which a Water Company Is Entitled.

Judge Noyes, of the California Supreme court, has rendered a decision in the case of the San Diego Water company against the city of San Diego, to set aside an ordinance fixing water rates. The case was first tried before Judge J. W. McKinley, then judge of the Superior court of Los Angeles county, who declared the ordinance invalid. Judge Noyes reviews this decision, saying that it is wholly unnecessary to discuss the many questions of law heretofore passed upon by the Supreme court of that and other states involving the constitutionality of such an ordinance. He declared it only necessary to pass upon the remaining questions of facts involving the value of the company's plant, the nature and amount of expenses for the year the ordinance was in force, the amount properly chargeable to the various funds, the revenue derived from the water rates, the rate of interest accruing to the company after the proper deductions had been made from the moneys received, and finally, the question of law as to whether such rate is an ample compensation to the company on the value of the investment, or is it of such meagre character as to be practically confiscatory in character, and thus violative of the constitutional provision to the effect that property cannot be taken or damaged without just compensation. The value of the water company's plant at the time of the life of the ordinance in question—and this includes that part of the plant not in actual use at the time but which subsequently is a proper and necessary part thereof, and also does not include the value of any "water

rights"—is $750,000. The operating expenses are shown to equal, if not exceed, the sum of $40,000, which deduction from the annual income for the year ending July 1, 1891—$65,788.65—leaves a balance of $25,788.65, which is practically 3 1-3 per cent. on the value of the plant does not equal the minimum current rate of interest obtainable on any practically safe investment during the year said ordinance was alive. The evidence submitted conclusively showed that such rate ranged from 4 to 8 per cent. and that the most uniform minimum rate was about 6 per cent. Judge Noyes was constrained, therefore, to hold that 6 per cent. was at the time the lowest current rate obtainable by borrowers on reliable securities. He says:

"I do not agree with some of the courts, or with some of the justices of our own Supreme court, that any rate of interest, however insignificant, is sufficient to satisfy the demands of the constitution, but on the other hand, I hold that the rate of interest obtainable must be of sufficient magnitude as to practically give to the plaintiff corporation a fair and reasonable dividend, such as it might obtain were the money that has been expended in the construction of the plant invested in any other safe and reliable securities. It follows, therefore, that the rates obtained by the plaintiff were of such a diminutive character as to be practically confiscatory and thereby rendered the ordinance void."

Decisions Relating to the Pollution of Streams.

An opinion by the Court of Errors and Appeals March 19, at Trenton, N. J., reverses the decision of the Court of Chancery in two suits involving the pollution of the Passaic river. In the case of Simonton against the city of Paterson the court decides that the city has legislative authority to sewer into the Passaic river, and cannot be enjoined from so doing. Justice Dixon renders the opinion in the case of Marcus Sayre, who obtained an injunction restraining the city of Newark from constructing the relief sewer. This injunction is set aside, and the opinion in this case is looked on as a most important and far-reaching one. It holds substantially that the city of Newark has the inherent power to adopt a legal sewerage system by which it can pour sewerage into the Passaic river, and that no individual along the banks of the stream can get an injunction to prevent it, but that if the work has been improperly performed, the remedy lies in an action at law. He says:

"The charter of the city of Newark grants to the munuicipal authorities of the city the right to use the Passaic river as such an outlet. The fact that such a use of the Passaic river pollutes the water and air in the neighborhood of a dock on the river owned by private persons and thus lessens the value of the private property will not justify an injunction to restrain the city from constructing and operating a sewer which the municipal authorities have within the limits of their legal discretion determined to be necessasry for sewerage purposes."

Justice Dixon cites ten causes which led to the construction of the sewer which was designed as a relief to a section of the city where the present system is inadequate to carry off the water, which backs up into the cellars of the houses. He finds that the plans for the sewer have been carefully prepared, and that it is a necessary step. This, he says, brings the court to the controlling questions in the case, namely:

(1) Whether the legislature had intended to authorize the city to construct and use such a sewer.

(2) Whether the legislature had constitutional power to grant such authority.

(3) Whether the complainants, as private owners of property, likely to sustain some incidental damage from the operation of the sewer, are entitled to have the city enjoined from exercising the authority conferred.

The court decides the first question in the affirmative under the charter of Newark and the supplements thereto. He cites the opinion of Chief Justice Beasley in the case of Stevens against Paterson, holding that the legislature had the power to grant lands in a navigable river below high water mark, without regard to the owner of the adjacent upland. This decision, he says, seems to place beyond question the power of the legislature to authorize the municipalities of the state to use the tidal navigable streams within its borders for sewerage purposes. The federal constitution interposes no obstacle to the exercise of such a power, provided the availability of the stream for interstate and foreign commerce be not impaired. It therefore seems clear that in New Jersey the legislature may constitutionally confer on the municipalities of the state the right to use tidal streams for sewerage purposes and that in the proposed construction and operation of the sewer now in question, the city of Newark is within the limits of its delegated authority. The question of individual damage which the sewer may cause is disposed of on the principle that if a corporation, though private, in the reasonable exercise of a franchise lawfully granted to it for a public purpose carries an incidental damage to private property such damage is damum abseque injuria. Judge Dixon says:

"There are decisions in the courts of this state to the effect that even negligence on the part of a public corporation in the

performance of a public function, whether quasi judicial or ministerial, will not justify an action for damages against the corporation or person who has sustained special damage by reason of such neglect."

Assessments in Michigan Upheld.

Judge Emerick has rendered a decision in the Chisholm street paving case, at Alpena, Mich., in which he holds the special reassessment valid. He says: "If anything can be regarded as settled in municipal law in this country, the power of the legislature to permit such assessments, and to direct an apportionment of the cost by frontage, should by this time be considered as no longer open to controversy. Writers on constitutional law, on municipal law, and on the law of taxation have collected the cases, and have recognized the principle as settled, and if the question was new in this state, we might think it important to refer to what they say. But the question is not new; it was settled for us thirty years ago."

Chicago Fails to Recover Damages from a Railroad Company.

Judges Freeman and Horton, of the branch Appellate court, rendered a decision recently affirming the ruling of the Superior court entered in 1898, finding the Northwestern Railway Company not liable for the $48,681 paid by the city of Chicago to property owners who claimed that the raising of the streets over the railway tracks had damaged their property. The ruling of the reviewing court was upon technicalities. When the suit was brought relief was sought by the city in a declarative setting forth of the existence of the alleged debt with no bill of particulars and demanding the payment of $10,000. The amount of damages was later raised to $75,000 and special counts were filed detailing the six judgments which had been recovered against the city in the years 1885, 1886 and 1887, which aggregated $48,681. The defendant company pleaded the statute of limitations as a bar to recovery on the special count which was declared to state a different cause of action. The Superior court sustained this objection. In his brief to the Appellate court, counsel for the city contended that the only question in the case was whether, if there was a legal obligation on the part of the railway company to build the viaduct and to pay such land damages as necessarily resulted, the law would imply from such an obligation a promise to the city to repay to it the money which the municipality had been forced to pay in judgments to aggrieved property owners.

Measurement of Crushed Stone.

A suit involving $20,000 has been instituted in one of the Maryland courts owing to a dispute in regard to the measurement of railroad ballast. The contractor insisted on having the different grades of stone measured separately at the crusher, while the engineer took the measurements after the aggregates were mixed and packed in place. As the voids in stone may amount to 30 to 50 per cent. of the mass, the difference in measurement is very great. "The Architect's Hand-Book on Cements" gives formulae for determining the exact measurement in any case.

Regulations of the Chicago Drainage Canal.

The engineering committee of the Chicago drainage board adopted by unanimous vote, March 12, resolutions declaring for the assumption of control of the main channel and the south branch of the Chicago river; the removal of all center-pier bridges and their replacement by draws of bascule type, and the policing of the stream by dispatch boats to direct the movements of vessels in the best interests of navigation.

Illegal Improvement Assessments in Iowa.

A decision was handed down recently by Judge O'Donnell at Dubuque, Ia., in which he held that the assessment in the Main street paving was invalid, and that the city could not have collected a dollar of the assessment if the porperty-owners had resisted the levy. All of the property-owners had paid the assesments except four. The improvement was made in 1892 and the assessment levied in November of that year. In accordance with the provisions of the law the city treasurer about a year ago advertised for tax sale the property on which the assessment had not been paid. The property owners secured a temporary injunction and began proceedings to have the assessments declared illegal. A review of the levy of the assesments disclosed the fact that the mayor had failed to sign the resolution ordering the improvements and that the notice to the property owners of the levy of the assessment was defective. In recent special improvements the bonds sold to pay for the same are secured by only the abutting property, while, in the case of Main street, the bonds are a municipal bond

and belong properly to the municipal debt. The contesting property owners claimed that the bonds are illegal and the assessment, therefore, invalid, because the city's constitutional limit of indebtedness is exceeded. The code of 1897 contains a provision to the effect that objections to the levy of assessments must be made within three months after the improvement is made, otherwise objection is barred.

Judge O'Donnell ruled that this statute applies now, but not to the assessments levied prior to the enactment of the law, as in the Main street case; that the assessments are a cloud on the title of the property owners and the owners have a right to bring action to have it removed at any time, and that they cannot be debarred from this right; that the assessments are illegal because of the illegalities in making the levy and because the city's constitutional limit of indebtedness has been exceeded, and that, therefore, a reassessment would not cure the defects. The city will appeal to the supreme court.

Required Specifications in Advertising for Bids.

The city of Detroit, Mich., has been enjoined by Judge Rohnert from collecting the assessment of the Case Farm company., Ltd., for the paving of Second-ave., from Colburn Place to the railroad crossing. The work was done last year and the court finds that in advertising for proposals the board of public works did not specify the time and place where bids would be opened as required by ordinance.

Street Cleaning in London.

In a recent paper on "The Unsanitary Condition of London Streets," by W. Nisbet Blair, surveyor of the St. Pancras vestry, he said that he had obtained information as to the method of working and the cost and the quantities of material removed during the period of about ten years in the parish of St. Pancras, in which the mileage of streets may be taken as 86 throughout the whole period. In the year ending March, 1891, labor in street sweeping cost $48,945; removal of sweepings, $37,380; a total of $86,325, 181 men being employed. The work at this time was entirely by hand, but the removal was by carts and vans supplied by contractors. Of about 750 streets only fifty were required to be cleaned daily, and about 69,000 cu. yds. of material were removed in one year.

In 1892-93 machine brooms were introduced, and in March, 1894, the expenditure for hand labor was $53,100, removal of sweepings, $67,040, a total of $120,140, the number of men employed being 183. It will be seen that, although eight machines were in use, the hand labor had increased in cost by about $5,000 by reason of higher rates of wages being allowed and the removal increased by about $30,000. About $5,000 was the cost of horsing the brooms, so that $30,000 can only be accounted for by the fact that there was more material to be removed—namely, about 83,000 cu. yds., or 20 per cent. more than 1890. By this time the schedules attached to the older contracts were omitted and the refuse on every street was cleared as often as material was swept up by the street sweepers or machines employed by the vestry, and it was arranged that every street should be visited daily, and in bad weather the more important streets are frequently swept throughout three times a day instead of two or three times a week. During 1898-99, the labor cost $57,100, the removal of road sweepings, $65,300, a total of $112,400, which is equal to $1,400 per mile. During this time 200 sweepers were employed and over 84,00 cu. yds. of material were removed. The present method of street cleaning is carried out by turning out the horse brooms, with water carts before them if need be in dusty weather, at 1 o'clock in the morning, together with sufficient men to direct their route, as the drivers of the machines are supplied by the contractors. At 6 o'clock the whole of the vestry's scavenging staff turns out and gathers up the ridges of material swept to the sides of the road by the machines, and to remove this material entirely from crossings and intersections. Soon after 6 o'clock the vans are driven around to gather up the material, and with each van one of the vestry's sweepers assists the driver who shovels up the material while the sweeper draws it together and cleans up with his broom. Main lines of thoroughfares are cleaned first, and the work proceeds in a similar manner throughout the day. In the main streets and more generally during the period of heavy slop the larger number of sweepers are working in gangs of from six to twelve men, and the remainder are working singly, each having a certain number of streets or length of street to keep in order.

The best means of disposing of the material he collects is left to the contractor. The drier portion from asphalt, granite and wood pavements can be sold as manure; the gritty stuff from macadam roads is used to some extent to temper clay for brick making and the remainder is shot

to waste wherever an outlet is available. Whenever wet slop is collected it has to be banked up and left to drain until it can be worked with shovel, and then it is sent away either by canal or rail. In one or two districts the slop is washed in a mill, and the clean grit is recovered for further use, either for mortar making or for sanding the roads again.

Mr. Blair made a series of observations for the purpose of comparing the cost of doing a given amount of work by horse brooms and by hand labor, with the object also of comparing the relative speeds at which the work was done. He found that one machine was capable of doing a given quantity of work in the same time and under the same general conditions as fourteen men, and the relative cost of the work by the machine and by hand labor was as 1 to 2½. During continued foggy weather, when the condition of the material on the roads is so sticky that it is not possible to remove it effectually either by hand or by horse brooms, as in the course of a few days a considerable quantity of greasy mud will accumulate on the roads, he found that the only way to remove it was by washing, and this practice has been occasionally adopted for some years. The process was extended under more regular conditions about twelve months ago, and observations were made as to the extent and cost of the work with the view of considering whether it would be beneficial to apply it over a larger number of streets in the parish. No extension was decided upon, however, owing to the cost. This work was done as follows: The water vans first traversed the road two or three times; the horse broom then followed; the material is then worked into a fairly flowing condition and is transferred to the sides of the road, the slop vans in attendance are at once loaded, and the whole of it is removed. The water vans again traverse the road, followed by the scavengers using rubber squeegees and brooms, and driving the whole of the material which may then be found on the road to the gullies. A gang of eight men with water vans and horse brooms can, in this manner, effectually clean an area of about 25,000 square yards during a night's work, everything being finished before 9 a. m. The cost varies with the character of the road.

The cost of a road paved with hard wood in good condition was 3¾d. per 100 super. yards per time, whereas a road paved with granite setts in fairly good condition costs 10d. per 100 super. yards per time. Mr. Blair was unable to give comparative figures for washing asphalt, owing to there being so little of that material in the districts' streets. In making a comparison between hose-washing and van washing, he found that the quantity of water used with the former was considerably greater than the van-washing, the proportions being slightly more than two to one. He says:

"It might be expected where streets have been paved to a very even surface with wood or asphalt that they should be kept much cleaner than they are, but the difficulty is that not only is mud produced by the droppings on any particular street under observation, from the sanding that it receives to reduce slipperiness, and from the refuse turned out upon it from adjoining premises, but there is also a large amount of dirt from adjoining streets transferred by the wheels of vehicles; and in any wide-jointed paving, such as granite setts, it is surprising what an amount of mud may be retained in the joints after the surface has been as effectually cleansed as ordinary processes can make it, for as soon as traffic begins to run over a road just swept horses' feet and wheels at once begin to disturb the mud from the joints, and it soon appears as untidy as if nothing had been done to clear it.

"We do not keep a record of the cost of cleansing or quantity of material removed from the different classes of pavement, but it is obvious that macadam must head the list; next to that I think granite paving must be placed, especially where tramways are laid, for the independent graveling by the companies, in addition to the tramway traffic, adds largely to the products of scavenging. Very close after this comes soft wood, the disintegration of which is very rapid, and the spongy nature of its surface assists to accumulate mud. Then I should place hard wood paving at a considerable distance below soft wood, for if paved with close joints its surface is almost impervious and it is easily cleaned. The material which I regard as costing least for cleansing is asphalt, but it is surprising how little slop on asphalt is necessary to secure splashing. House and shop fronts bear witness of this, and a trotting horse distributes a muddy spray over an extensive area."

Filtration Laboratory at Philadelphia.

A filtration laboratory is being built at Philadelphia for William C. Haddock, director of the department of public works. The laboratory is located at the Spring Garden pumping station, and consists of two sedimentation basins, two slow sand filters, nine tanks for mechanical filters and a laboratory. The sedimentation basins and filter beds are made of Portland cement concrete, with the exposed surfaces covered with a mixture of equal parts of Portland cement, sand and granolithic grit. The entire laboratory is housed in a frame building about 50x120 feet.

Questions as to Concrete.

At the Detroit meeting of the Association of Railway Superintendents of Bridges and Buildings, W. A. Rogers, engineer of permanent construction of the bridge and building department of the Chicago, Milwaukee & St. Paul, was appointed to present a paper at the next meeting on "Concrete." To bring out an expression as to whether concrete is a suitable and economical material for bridge piers, abutments, culverts, arches, etc., it is desired that answers to the following questions be sent to Mr. Rogers at Chicago:

For what classes of structures do you use natural cement concrete?

What proportions of materials do you use in making natural cement concrete?

For what classes of structures do you use Portland cement concrete?

What proportions of materials do you use in making Portland cement concrete? If you use a different proportion for different classes of work, please give that for each class.

If you have a cement specification please send a copy.

Please state your requirements as to the sand, gravel, stone or other aggregates used.

Please state the process followed in mixing and placing concrete. If you use a machine for mixing, please state the kind, and say if in your opinion better results are obtained with it than may be obtained by hand mixing.

Do you prefer a dry, moderately wet, or wet mixture? By dry mixture is meant one which requires a repeater ramming to bring water to the surface; by wet mixture is meant one which quakes when slightly rammed.

Have you experienced any trouble on account of cracks forming between successive layers of concrete, especially when one layer has been placed after the one below has started to set? What method have you adopted to obviate this difficulty?

What if any provisions do you make for expansion and contraction due to changes of temperature?

Do you face concrete exposed to the weather? Please describe the facing used, and method of putting it on, and say if you have had any trouble with its crackling off?

Please describe the form of mould you use.

Have you had any experience which leads you to think either favorably or unfavorably as to the practice of mixing concrete in freezing weather?

What has been your observation as to the action of frost on natural or Portland cement concrete after it has set?

Please give the amount of cement and the various aggregates required to make a cubic yard of concrete of the proportions you use.

Please state the cost per cubic yard for the labor of mixing and placing, stating the rate per day for labor on which this is based, and just what items the cost covers.

What difference in cost between concrete and stone masonry do you find?

Please give the results of any experiments you may have made to throw light on the properties of concrete.

Please state any reasons you may have for or against the use of concrete in railway bridge or building work.

Right to Open a Street Through Railroad Yards.

The United States Court of Appeals affirmed the decision of Judge Baker, March 3, restraining the city of Terre Haute, Ind., from proceeding to open Ohio-st. through the yards of the Evansville & Terre Haute Railroad company, pending an appeal taken by the company from the award of damages by the city commissioners. The case has been before the city authorities and the courts for thirty years. The railroad company once offered to build a viaduct at its own expense, but the property-owners in the immediate vicinity objected. The city council then attempted to open the street at grade. There are thirteen tracks at the crossing point. In the hearing before the commissioners on the question of damages the railroad company's witnesses testified that the company would be damaged from $250,000 to $500,000, but the commissioners awarded about $20,000, a real estate value only, not taking into consideration the loss incurred to the company in the operation of its business.

Technical Meetings.

The American Society of Civil Engineers has been notified that the annual "Conversazione" of the Institution of Civil Engineers will be held at the Guildhall in London July 5. A cordial invitation is extended to all members of the American Society of Civil Engineers then in London to attend the entertainment. Ladies are included in this invitation. Members of the American Society intending to visit London this year are requested to at once notify Chas. Warren Hunt, secretary, of the date of sailing, and name of ship on which passage has been secured.

The nineteenth annual meeting of the American Street Railway Association will be held at Kansas City, Mo., Oct. 16-19. T. C. Pennington, secy.-treas.

At the regular meeting of the Brooklyn Engineers' Club, March 8, Daniel D. Jackson presented a paper prepared by George C. Whipple on "The Action of Water on Asphalt." The object of this paper and the subsequent discussion was to learn as nearly as possible what effect the various kinds of waters have upon asphalts. Mr. Jackson pointed out the rapidly increasing

use of asphalt and the most important uses to which it is put—paving of streets and lining of reservoirs. The difference of opinion among the members lay in the quantities of fresh and salt water as asphalt destroyers. Asphalt paved streets and asphalt lined reservoirs have been in contact with fresh water constantly and apparently have not suffered, but scientific tests prove to the contrary and go to show that salt water is the less damaging. To show the advisability of using salt water in the cities a course of investigation was pursued, and it was observed that the waters that contained the smallest amount of minerals produced the greatest action upon asphalt. Salt water gave but little action. In order to obtain comparative results upon this point samples of various asphalts were subjected to the action of distilled water, sea water and a concentrated brine solution in glass jars. After two months it was found that the distilled or fresh water showed considerable action, the sea water a very slight action and the brine no apparent action. Some of the brine solution was also allowed to stand over the surface of an asphalt that had been already acted upon by the fresh water. No change of color took place, and this indicated that the salt itself exerted no chemical action upon the asphalt. A test made showed that the action of water upon asphalt is largely one of oxidation, and is due to the oxygen dissolved in the water. From investigations made the conclusion was reached that the action of water upon asphalt is due to the unsaturated nature of the hydrocarbons present, as it is attended by a partial solution of the asphalt in the water. There is also a loss of sulphur as hydrogen sulphide, and an increase of weight of the asphalt itself due to oxidation and to the mechanical admixture of water. The most important action that occurs is that produced by this oxidation of the asphalt by means of the dissolved oxygen in the water.

The regular meeting of the Engineers' Club of Minneapolis was held March 19, when a paper by Prof. Geo. D. Shepardson on "Street Lighting" was read.

The Engineering Society of the South held its regular monthly meeting March 8. John Wilkes presented a paper on "Gas Engines and the Economy of Gasoline Engines for Small Power," in which he gave a brief history of the development of the gas engine, and a description of the principle of operation and manner of construction. The various types commercially before the public were reviewed, the advantages and disadvantages of each being pointed out. The cost of operation of several gas engines, varying in horse power from two to thirty, was given, the figures showing remarkably low costs. For small power and at isolated locations the gas engine was declared to fill a long felt necessity. However, it was shown that the gas engine might yet be greatly improved along the lines of simplicity of construction, more efficient manner of starting, and steadiness in running.

Municipal Reports.

Twenty-third Annual Report of the Executive Board of the City of Rochester, N. Y., for the year ending Dec. 31, 1898.

The reports of the various departments comprise a volume of nearly 200 pages. It is unfortunate that their publication was delayed for over a year. Mr. E. Kuichling, chief engineer of the water works department, briefly refers to methods by which the purity of the water supply from Hemlock lake is maintained. This is done by a system of collection and disposal of contaminating materials in the district surrounding the lake by means of a "pail service," and also by the abatement of improper drainage conditions of barnyards, etc., on the course of tributary streams of the lake. In addition to this service around the lake a general sanitary supervision is also maintained over the entire watershed. In connection with the water department weekly chemical and biological examinations are made of water from Hemlock lake. The analyses show very little variation in quality during the last five years. Incomplete data has beeen noted as to comparative leaks in lead joints and cast iron pipe, but the information is not sufficient as a basis for comparison between the costs of maintaining the two kinds of pipe. Mr. Kuichling says, however, that from what is known of former conditions it is safe to assert that the maintenance of the cast iron portion of a conduit has been less expensive than that of an equal length of the riveted portions. The principal reason for this disparity is doubtless found in the much greater length of the individual riveted pipes, which are from 27 to 81 feet long and have cast iron bells or sockets for lead joints riveted to one end whereby the repeated and appreciable expansions and contractions due to variations in the temperature of the water at different seasons ultimately cause a loosening of the lead joints and thence leakage. Some interesting notations are made by Mr. Kuichling of his observations regarding vegetable growths and tuberculative conditions in the interior of large water mains. This growth formed an almost continuous lining with frequent

large masses hanging down from the top. The lining in general resembled a dense fibrous mat from one to two inches thick and the glossy pitch coating of the pipe is visible only in a few places. Examinations showed that these growths consisted mainly of two species of Polyzoa and one of fresh water sponge. Similar growths, along with extensive tuberculation, were found in the old effluent pipe from the reservoir when partially removed in 1894. The effect of these conditions was to considerably diminish the discharge through the conduits so affected. Mr. Kuichling says that the use of water meters is having a beneficial effect in reducing the consumption of water and is resulting in better comparative uniformity of the rate of consumption in the various seasons. The extreme variations in consumption represent, respectively, 12.1 per cent. above and 5.8 per cent. below the average, whereas in cities where meters are not extensively used such percentages are always very much greater. The statistical data accompanying Mr. Kuichling's report is, as usual, exceptionally valuable and complete and embraces a large number of tables.

Mr. E. A. Fisher, the city engineer, gives a review of the work of his department covering details quite fully, in connection with which some illustrations of street work are shown and which are reproduced elsewhere in this number. Mr. Fisher advocates in his report the requirement of general regulations relating to guarantees, bonds, etc., for all pavements similar to those in force for asphalt pavements.

Fifth Annual Report of the Board of Public Works of the City of Little Falls, N. Y., for the year 1899. John McComb, City Engineer.

Mr. McComb reports that the coke filter chamber operated in connection with the water works has given very satisfactory service. He advises the gradual replacing of vitrified pipe with cast iron pipe, believing that the latter will be cheaper in the end. He says that the reinforcing of vitrified pipe by using cement after the pipe has become cracked from settling or from other causes is a waste of time and money.

Third Annual Report of the Commissioners of Water Works of Cincinnati, O., for the year 1900.

In the report of Mr. Herrmann, as president of the board of trustees, it is stated that the entire cost of the experimental station for the investigations into the purification of Ohio river water, as conducted by Mr. George W. Fuller, was $41,672.81. After the abandonment of the station a portion of the plant was sold for $2,094. The board regards "the data obtained from the work as worth ten times the cost, as, from the reading of the chemist's report it is apparent that very serious mistakes could and probably would have been made, involving an expenditure of hundreds of thousands of dollars, had the experiments not been made." The report of the chief engineer, Mr. G. Bouscaren, is almost entirely devoted to a review of the contracts for the improvements in the water works.

Fifth Annual Report of the Board of Water Commissioners of the City of Johnstown, N. Y., for the year 1899. George A Stewart, President.

The abundance of the water supply throughout the period of drought is regarded as proof that the supply is ample for all purposes and under all conditions. To encourage large use of water for commercial purposes the meter rate was reduced to 8 cents per 1,000 gallons to all consumers using 5,000 gallons per day and 6 cents to all using 10,000 gallons per day.

Annual Report of the Street Commissioner of the city of Worcester, Mass., for the year ending November 30th, 1899. Wright S. Prior, Street Commissioner.

Mr. Prior asserts that the street department of Worcester during the last year did more and better work than in any previous year in its history. There was an unprecedented amount of snow removal followed by a large amount of sidewalk and street paving. Snow removal cost nearly $20,000, while the usual expense is about $6,000. Over six miles of sidewalks were built, all of which were brick with the exception of 1.19 granolithic. Macadam paving to the extent of 82,600 square yards was done, at an average expense of 60 cents per square yard for new work and 28 cents for resurfacing.

Ninth Annual Report of the City Comptroller of Indianapolis for the year 1899. E. M. Johnson, Comptroller.

Mr. Johnson's report shows that there is a large falling off in receipts for the year 1899 on account of the enactment of laws that practically exempt about two-thirds of the voters of Indianapolis from paying any taxes, unless they volunteer to do so. The tax levy was reduced from 70 to 59 cents on the $100, which is the lowest rate in the country for a city of the population of Indianapolis. This will result in a deficiency in the revenues. Mr. Johnson sees no reason why abundant means for special purposes may not be obtained by requiring reasonable compensation to the city for the use of public utilities by private corporations. The report shows that there is a margin of $313,116 in the indebtedness of the city under the 2 per cent. constitutional lim-

it. The total amount of bonds issued under the Barrett law on account of public improvements is $2,650,584, and there is now outstanding $1,202,326. Mr. Johnson urges the necessity of a sinking fund for the gradual extinction of the city's debt.

Report on the Condition of the Public Water Supply of the City of Highland Park, Ill.

This pamphlet comprises several reports from the Highland City Park Commissioners, the Citizen's Association Committee and a Committee of the Illinois State Board of Health. There is agreement in the conclusion that (1) the water at Highland Park intake is impure and cannot be safely used; (2) it is necessary that the water be artificially purified before using for drinking purposes; (3) Highland Park should adopt slow sand filtration and provide an adequate area of filters for present use, having in mind the means of extending the plant as the consumption of water increases. It is estimated that the proposed sandbed filter will cost about $15,000. The employment of a sanitary or civil engineer to have charge of the construction is recommended. In connection with the investigations a report on sewage disposal has been made by J. A. Harman, engineer of the State Board of Health. Mr. Harman says that the purity of the water supply taken from Lake Michigan is in jeopardy so long as any of the cities along its shores discharge sewage into the lake without first purifying it. The general plan of disposal advocated by the board is that practically all of the sewage produced by the various cities can be diverted in the valley of the north branch of the Chicago river where there is an abundance of land upon which to construct sewage purification works. By the construction of an open channel through the valley of the east fork of the north branch the purified effluent could be discharged into the north branch of the Chicago river in a state which would not be cause for any nuisance or be any detriment in any way to the stream into which it would flow.

Annual Reports of the Officers of the City of Columbus, Ga., for the year 1899. R. L. Johnson, Supt. of Public Works.

Superintendent Johnson notes with gratification the extension of stone curbing on the streets of Columbus, of which it seems heretofore there has been comparatively little. The street paving has been largely Telford, the cost of which has averaged $1.0814. As an experiment a shell rock pavement was laid on Broad-st. The street committee was induced to use it after investigation of some pavements of this material in Macon, where shell pavements have been in use for two years, and it is claimed show little or no appreciable deterioration or wear. The material is composed almost entirely of shell fish and other crustaceous marine animals which were deposited ages ago in certain geological formations, and it became solidified into cakes of soft rock. The particular deposit from which is obtained the rock used in the pavements in Macon and Columbus is situated about thirty miles south of Macon. It is quarried at the mine in open cut very much the same as other rock or hard material is handled—that is, by drilling and blasting. It is then crushed by machinery, and in this condition is laid on the prepared roadbed of the desired thickness, after which it is rolled until smooth, hard and firm. A medium weight roller is regarded as the best for this purpose. The road-making qualities of the shell rock are due to the particular property it possesses on compacting under pressure of the roller, forming a solid mass nearly as firm and hard as in the original state of the deposit. The cost of the Columbus pavement was 0.4952 per square yard. It is estimated that it can be laid on any of the streets of Columbus at a cost not exceeding 55 or 60 cents per square yard.

Annual Reports of the Officers of the City of South Norwalk, Conn., for the year 1899.

The health board has had a sanitary survey of the city made as the first step toward sewer construction, for which there is much need. On the subject of municipal ownership of electric lighting plants, the electric light commissioners say:

"If any answer is necessary in defense of municipal ownership of electric lighting plants at this date when upward of 400 of such plants in the country alone attest to its popularity, to which new ones are being added at the rate of one each week, we believe that South Norwalk is in a position to supply such an answer backed by satisfying results and ample experience gained from a plant that is operated to all intents and purposes on the same lines as though it was owned by a private corporation. Only an item of taxes need be added to make the comparison complete, an item which would not materially change the results, and which is more than made up by the maintenance of the fire alarm system without cost to the city. In the cost of street lighting alone it can easily be shown that the plant has saved the city over $1,000 yearly for the past seven years, and the income from commercial lighting is sufficiently encouraging to give reason for the belief that it will pay the bonded debt of the plant by the time the bonds become mature, and at the same time afford its patrons a good service at low rates."

The report of the water commissioner shows large waste, as the deli··ry equals 240 gallons per day per ca

Twenty-second Annual l ort of the Board of Health of the City of Lowell, Mass., for the year 1899.

The most important work of the year was in establishing a system for the collection and disposal of garbage. The crematory process was adopted, and for all of the work a contract was made at $26,500 per year. The pollution of the Merrimac river, from which the water supply is taken, by emptying into it of sewage from towns above Lowell has been productive of a heavy typhoid mortality. This mortality was considerably reduced by inducing a larger use of driven well water. Efforts for relief are directed at present to this plan.

Personal Notes.

Thomas Shannon has been elected mayor at Bath, N. Y.

George W. Ough has been elected mayor at Albion, N. Y.

Frank J. Nelson has been elected mayor at Hornersville, N. Y.

Joseph E. Lewis has been re-elected controller, at Pittsburg, Pa.

L. E. Farnham has been reappointed city engineer at Camden, N. J.

Wallace Greenalch has been appointed deputy city engineer at Albany, N. Y.

B. E. Shifley, Bucyrus, O., has been appointed city engineer at Owensboro, Ky.

William McClelland has been elected president of the council at Uniontown, Pa.

John B. Reeves has been elected president of the council at Beaver Falls, N. Y.

George M. Bull has been appointed assistant city engineer at Troy, N. Y.

John J. Carney has been elected water commissioner for three years, at Westerly, R. I.

Alexander Oldham, city engineer at Grand Forks, N. D., died of apoplexy March 5.

E. J. Brandon has been appointed field assistant to the city engineer of San Francisco, Cal.

Charles E. Russell has been appointed city engineer and superintendent of water works at Boone, Ia.

John C. Otis, president of the Union Water Meter company, Worcester, Mass., died March 10.

John L. Shaw, superintendent of water works and lighting, Grand Rapids, Mich., died March 8.

J. M. Bauer, Lindon, N. J., has been appointed engineer of the proposed road work in Union county.

Frederick T. Johnson has been appointed city comptroller at Newark, N. J., to succeed John S. Gibson.

George D. Chapman has been appointed superintendent of the Fitchburg Machine works, Fitchburg, Mass.

H. W. Benn has been elected president of the council, and William Howatt city engineer, at Braddock, Pa.

Fred A. Coleman has been appointed city engineer, at Rome, N. Y.

Addison C. Rand, M. Am. Soc. C. E., president of the Rand Drill company, died March 9 at his home in New York City.

John H. Slingerland has been reappointed superintendent of dam construction by the Croton Aqueduct Commission, New York City.

Dr. S. A. S. Jessop has been re-elected president of the council, and David McMaskes street commissioner, at Kittanning, Pa.

Charles A. Van Keusen has been appointed chief engineer of the street and water board for a term of two years, at Jersey City, N. J.

C. F. Gibson has been elected president of the council, Malin Ewing city clerk, and Alexander McDonald city treasurer, at Sharon, Pa.

W. H. Ambler, W. H. Stark and William Phillips have been appointed electric light and water commissioners at Northville, Mich.

H. Mueller, founder of the H. Mueller Manufacturing company, Decatur, Ill., died recently of injuries received in an explosion of gasoline.

Bertrand T. Wheeler has been appointed superintendent of streets and Edward J. Donavan has been elected city clerk at Boston, Mass.

George S. Rice, M. Am. Soc. C. E., Boston, Mass., has been appointed deputy chief engineer of the Rapid Transit Commission of New York City.

Homer A. Reid has been appointed to a position in the bridge department of the office of the State Engnieer and Surveyor at Albany, N. Y.

Joseph P. Horstman has been appointed assistant civil engineer on the public improvements in the provinces of Matanzo and Santa Clara, Cuba.

Linus W. Brown has resigned his position as chief engineer of the National Contracting company, which has been building the drainage works of New Orleans.

Frank Heeber has been re-elected president of the council, John Hunter city engineer, and John Humphries street commissioner, at McKee's Rocks, Pa.

Everett Garrison has been appointed chief engineer, John B. Van Buren consulting engineer and Curtis Staunton superintendent of the water commission at Newburgh, N. Y.

Thomas I. Rae, who has been connected with the Thompson Meter company of Brooklyn, N. Y., for twelve years, died March 6, at the Clarendon hotel, New York City.

John R. Bullard, Dedham, Mass., president of the Dedham Electric Lighting company, and treasurer of the Dedham Water company, died March 16, of apoplexy, aged forty-four years.

Gustav Schimpff, Berlin, Germany, an engineer in the employ of the Prussian government, is visiting the United States for the purpose of studying electric street railway systems.

J. B. Newhall, general manager of the Crystal Meter company, Edgewater, N. Y., has resigned his position and opened an office as a general contractor at 184 Bay-st., Stapleton, N. Y.

S. L. F. Deyo has been appointed engineer-in-chief to John B. McDonald, contractor for the New York Rapid Transit

railway, and Charles Sooymith has been retained as consulting engineer.

Charles F. Knowlton, who was recently appointed commissioner of public works at Quincy, Mass., has accepted the office of engineer of surveys and construction, department of public works, Porto Rico.

Marston Campbell, Oakland, Cal., has been appointed supervisor of streets, roads and bridges in the Department of the Interior, Hawaii. Mr. Campbell was until recently deputy city engineer of Oakland.

John Grant, manager of the Grant Paving company, Omaha, Neb., has been temporarily appointed manager of the Barber Asphalt Paving company, in that city to fill the vacancy caused by the death of Charles E. Squires.

William E. Ward, a charter member of the American Society of Mechanical Engineers and the American Association for the Advancement of Science, died at Port Chester, N. Y., March 2. Mr. Ward was born in Indiana in 1821.

Frank L. Hand has been appointed chief of the water bureau at Philadelphia, Pa., to succeed John C. Trautwine, resigned. Mr. Hand has served for fourteen years as assistant chief and general superintendent of the water bureau.

J. M. Wright, Detroit, Mich., who has been superintendent of the Barber Asphalt Paving company in that city, has been elected president of the Alcatraz Paving company, with headquarters at 329 W. Ninth street, New York City.

John W. Hill, Cincinnati, O., has been appointed consulting engineer to the director of public works and the chiefs of the bureaus of surveys and water, Philadelphia, in connection with the improvement of the water supply of that city.

Bernard M. Shanley, Newark, N. J., died of apoplexy, March 20, aged fifty-two years. Mr. Shanley was a member of the firm of B. M. & J. F. Shanley of Philadelphia. He was known throughout New Jersey as the "Napoleon of Contractors," for no work was too stupendous for him to undertake, and he was also considered one of New Jersey's greatest financiers.

Ernest G. Freeman, M. Am. Soc. C. E., died March 6 at Augusta, Ga., aged thirty-three years. Mr. Freeman was associated for more than two years with L. L. Buck, present chief engineer of the new East river bridge, and was resident engineer in charge of construction on the ocean pier of the Trinidad Asphalt company, at Trinidad, W. I., and later pursued certain investigations in the asphalt deposits of Venezuela for that company.

Mr. D. W. H. Moreland, formerly of the Board of Public Works of Detroit, has become the President of the Zenner Disinfectant company, which produces disinfectants for public sanitary purposes. Special attention is given to making disinfecting machines for public buildings and also for use in large public works and health departments where it is necessary to disinfect on an extensive scale, as for instance the distribution of disinfecting fluids by use of sprinklers in times of epidemic and contagion. These disinfectants have the indorsement and are largely used by some of the foreign countries and also in use in over two thousand passenger coaches on railroads in the United States.

Municipal officers have been elected or appointed as follows: T. W. Hugo, mayor, Duluth, Minn., Major M. B. Butler, mayor, Niagara Falls, N. Y.; John Humphries, street commissioner, McKee's Rocks, Pa.; John Hunter, borough engineer, Hollidaysburg, Pa.; Robert J. Black, mayor, McKeesport, Pa.; Dr. Frank H. Flood, mayor, Elmira, N. Y.; C. A. McFarland, water superintendent, and George McWilliams, street commissioner, Canonsburg, Pa.; Samuel Rine, water works superintendent, Bellefonte, Pa.; George W. Lane, mayor, Corning, N. Y.; James Grundy, street commissioner, Millvale, Pa.; Samuel G. Bair, highway commissioner, Pottstown, Pa.; George W. Ough, mayor, Albion, N. Y.; Ralph E. Shaner, surveyor, Pottstown, Pa.; B. H. Willaner, water superintendent, and Howard Detwiler, street commissioner, Phoenixville, Pa.; Frank J. Nelson, mayor, Hornellsville, N. Y.; Cameron Corson, engineer, Norristown, Pa.; W. S. Pugh, highway commissioner, Pottsville, Pa.; Michael Roach, water superintendent, Girardville, Pa.; F. W. V. Lorenz, surveyor, Shamokin, Pa.; John W. Houser, water commissioner, Chambersburg, Pa.; J. H. Silfies, engineer, Pen Argyle, Pa.; Thomas Shannon, mayor, Bath, N. Y.; Frank Kunkle, engineer, Nazareth, Pa.; J. M. Walmsley, street commissioner, Hatboro, Pa.; Arthur Welsh, street commissioner, Jenkintown, Pa.; Joseph W. Hunter, surveyor, Topton, Pa.; Harry Miller, borough engineer, Rankin, Pa.; J. M. Johnson, street commissioner, Turtle Creek, Pa.; John Schroth, water works superintendent, Sharpsburg, Pa.; Conrad Fix, street commissioner, Prospect Park, Pa.; J. R. Bowers, water works superintendent, J. B. Morton, street commissioner, and S. A. Taylor, engineer, Duquesne, Pa.; J. W. Patterson, engineer, and Mathew S. Best, street commissioner, Knoxville, Pa.; John S. G. Dunne, engineer, Ardmore, Pa.; G. A. Gilfillan, engineer, Espien, Pa.; S. M. Foust, engineer, Connellsville, Pa.; H. T. Barker, engineer, Beaver Falls, Pa.; A. G. Whittemore, water commissioner, Dover, N. H.; Steven M. Sherwood, water commissioner, Sing Sing, N. Y.; Oren E. Parks, town engineer, Westfield, Mass.; Edward D. Very, engineer, Niagara Falls, N. Y.; W. S. Haines, engineer, Haddenfield, Pa.; W. J. Charlton, water works superintendent, Peekskill, N. Y.; W. A. McDonald, engineer, and E. A. Mercer, superintendent water works, West Chester, Pa.; William M. Carter, city surveyor, Woodbury, N. J.; F. Walter Toms, chief engineer water department, Camden, N. J.

SELECTIONS FROM THE PRESS.

The Laying of a Cement Sidewalk.

BY MATT MOLLISON.

To properly construct or lay a cement sidewalk one should be more or less practical in such work, also conversant with the uses and conditions of cements, sand, stone and crushed granite, and also a good judge of weather. These are a few of the many parts required to produce a good and lasting result in doing this class of work.

Today we find that there are many more sidewalks put down with this material than there were some eight or ten years ago, with the usual result of cheapening the work and veneering it over with a pretty finish, which to the impractical eye and mind is a work of art. This is generally a condition produced by the men who have drifted into the business "because it is so easy." As a rule they are men who do not know a trowel from a float, and, therefore, have to depend on the services of a good or bad foreman, with the result that the fine veneer finish on the surface fools them as well as the customer for whom the work is being done. Very likely he thinks that he is doing all right and producing good results for himself and also for the business at large. But look at the work six months or one year from the time of its laying and you will find the benefit accrues only to the man who laid the work, as it is generally hollow, cracked, or going to pieces.

All this could be avoided by paying and getting for your money a first-class and lasting piece of work, with the result that instead of this work degenerating into what is commonly called a skin business, it would maintain its place as one of the many important parts of the building business. An inspector is put on to see that iron work, fire-proofing and other parts of the building are as the law requires; why not see that this is carried out under as strict regulations?

To look over some of the work done ten or twelve years ago and see how perfect it is today, speaks well for the care it had in laying, also that each part had the proper amount of cement, water, etc., and also a very necessary item, the amount of money paid per foot was more what it should be than now. In the end you are much better served than by the pretty, slim work of today, laid by the men who say "it is easy."

From a practical standpoint, a concrete sidewalk is as good and even better than a fine five-inch or six-inch bluestone pavement, at very much less cost. It will not scale on the surface as does bluestone, will not polish as do heavy granite sidewalks and will stand as much weight, strain and rough usage as any of the above kinds of pavement if properly constructed.

Billiard table tops are made with a mixture of crushed granite and Portland cement, which proves the surface or finish such a mixture will take on.

It is not the intention to write a formula for the introduction into the business of the impractical man, but as a hint or assistance to architects and those interested in cement construction.

Take a sandy or gravelly bottom which is porous and will not hold water to freeze and we have a good start. On a loamy or clay bottom we have a bad start, as same is likely to freeze, dry up or heave. If on a sand or gravel bottom, one can start by putting down the concrete pavement at not less than five inches thick all over, divided in two layers of four inches concrete and one inch of top or wearing surface; if on a loamy or clay bottom, it is necessary to excavate to a depth of from eighteen to twenty-four inches, placing end stone in the excavation. This may be from twelve inches to fifteen inches long and must be placed on edge. Cover this to within four and one-half inches of finished surface with clean cinders (not ashes), then thoroughly wet same and have men go over the work with neat, square iron rammers, getting it evenly rammed to the required grade. In ramming it is not necessary to break the handles, but a clean, neat, smart pounding is much better than trying to make a hole every time the rammer goes down. The same can be said about ramming concrete. After your cinder grade is all neat and true then proceed to get your concrete in place ready to receive the finishing top. In mixing the concrete see that it is thoroughly mixed, in a dry condition first, and then add sufficient water to make it tough and not juicy. This may be turned over to get each part equally damp and not wet in clots. Have this wheeled or carried to where your guides or scantlings are set, put it in place and ram as mentioned above.

Observe that the edges against your guides or scantlings get a specially good ramming, this point being generally neglected, because it is apt to push the guides out of place.

When you have decided upon the amount of work to be laid or finished, and have some concrete in place, let your topping

gang go ahead and keep covering the concrete already in place. Do not keep the concrete surface exposed longer than it takes the topping gang to cover it.

The top or finished surface to be of fine crushed granite and Portland cement, same thoroughly mixed in a mortar box and kept wet in sufficient quantities as the demand requires. This should be steadily gauged and kept worked, the distance to be carried being as short as possible; in fact, have the box right on the work if convenient. This allows the mixture to be put down to the mason in its proper condition and not all hard or all water. It does not take long for it to form solid in a pail, as it often does, and when dropped out left to the mason to regauge with float or straightedge, making in the work on top, patches of apparently good material, but next the concrete, a mass of granite, dried and separated, full of air spaces and without bond.

Some advocate the use of dryers, or fine sand and cement in rich proportions which is generally sprinkled over the already laid top surface and floated into same by use of a wooden float. Unless great care is taken not to have too much and also to see that it is thoroughly worked into the top coat, it will scale off and make a poor surface.

The method of marking the surface is all a matter of taste, and there are many and better methods of marking than those in use at present, which would give a good footing to pedestrians.

As to weather conditions, cement work should never be laid if there is a frost or any chance of frost and is best laid in damp or cloudy weather. If the sun or wind is strong it is advisable to keep the work thoroughly wet, and the more water it gets, thus retarding the set, the better the result.

These are a few points that are generally understood, as to what to do and when to do it, but there are so many points in this work that are all a matter of practice, and which only come to one by the use of tools and brains, that it would be impossible to write in detail what they are.

To get the best work use only the best materials as to Portland cement, the best of gravel, or sharp, clean sand, and one inch broken stone for concrete, and only use for your wearing surface crushed granite.

Granite is a stone that when crushed forms into a cube (most others flake or sprawl) so that when sufficient cement is added and worked in a one-inch wearing surface it packs by tapping, into a solid mass, presenting to the surface the face or surface of a cube, which, of course, will wear down only as time goes on. A flaked stone may present the surface of a flake to the wearing surface and be about as thin as paper, and naturally it will work out or wear out leaving a hole in the walk. Next to granite a hard, clean, angular or sharp sand is the best for such work.

In laying out work of this kind one is guided by previous experience. Try to avoid laying the pavement in triangular lines running to a point, and if possible keep lines square and at right angles. It is well to keep same in a body or mass. It will be observed that very often in five-foot squares the pavement is cracked. This is generally accounted for by the use of faulty material, frost or carelessness.

It would be a good thing if architects would insist on quality of work in cement the same as any other material; they could then get as fine and lasting a pavement in cement as in any stone.

The uses of cement abroad are much more extensive and more appreciated than in this country, all kinds of copings, steps, platforms, etc., being made with this useful material.—Cement.

MACHINERY AND TRADE.

A New Trenching Machine.

The accompanying photograph represents a machine for excavating narrow and shallow trenches for water and gas pipes and sewer work, which has been in use during the past summer by John A. McGarry & Co. at Evanston, Ill. In this work it has proved eminently successful and if equally as good results can be obtained in such general work the cost of digging small trenches for laying water and gas pipes will be materially reduced. No machine has ever before been devised which will dig these small trenches economically and satisfactorily. The earth is loosened by eight plows fastened at and extending some distance in front of the large wheel shown in the illustration at the rear of the machine. These plows are spaced equi-distant and determine the width of the ditch,

as they can be fastened at certain widths by means of liners. The excavation is accomplished by rotating the large wheel, which is about 12 feet in diameter, by means of a sprocket chain in the direction of the body of the machine. Attached to the circumference of the wheel by an automatic lock and hinged to the center of the wheel are eight buckets which follow the plows and excavate the loosened material. As the filled buckets reach the level of the frame upon which the axle of the large wheel is carried, its lock is automatically released and the bucket swings out from the wheel by gravity and is gradually turned up side down by the revolutions of the wheel until it is emptied. In its downward course the bucket swings into the wheel by gravity and upon striking the circumference, it is again locked ready for another load. The machine is so arranged that the entire dead load is on undisturbed ground. Power is furnished by a small engine and the machine is moved ahead by a chain fastened two or three hundred feet in advance. The entire machine weighs about 5½ tons and a 15-horse-power engine is used. The company reports that in its operation the past season only five men were employed, consisting of a foreman, engineer, fireman and two laborers. The greatest amount of work performed in one day, of nine hours, was the excavation of 470 lineal feet of trench 6½ feet deep and 3 feet wide. This excavation was in a very tough and stony hard pan. The least amount of work performed in nine hours was the excavation of 300 lineal feet of trench 6½ feet deep and 3 feet wide, the poor showing being due principally because of delays caused by breaks in machinery. Three feet is the widest trench which has been excavated and 7½ feet is the greatest depth.

MACHINE FOR MAKING SMALL TRENCHES.

Web Tile Sewers.

The National Web Tile Sewer company, who manufacture a web tile for constructing sewers of all sizes, report they have secured a contract at Syracuse, N. Y., for the construction of about 6,970 lineal feet of egg-shaped web sewers, ranging in long diameter from 48 inches to 78 inches. Bids were received some time since for constructing these sewers both with brick and web tile, manufactured by this company, and their proposal was accepted because it was the lowest submitted. This material has also been specified in two trunk sewers to be let in Syracuse the coming summer.

Difficulty Encountered by the Sewer Pipe Trust.

The American Clay Manufacturing company, known as the sewer pipe trust, was refused a certificate of incorporation March 9, at Columbus, O., by Secretary of State Kinney, who held that the articles of incorporation were in violation of the Ohio anti-trust law, and he could not issue the customary certificates granted to foreign corporations without first securing an opinion from the attorney-general. The

provision of the anti-trust law to which objection was made is that which authorizes the company to purchase stock in other companies and exercise all the right of ownership over the same.

Recent Inventions.

(Reported especially for MUNICIPAL ENGINEERING by Arthur M. Hood, Indianapolis, Ind. Copies of any patent may be obtained for ten cents.

No. 643,857. Feb. 20, 1900. Excavator and Ditcher. E. M. Zahl, Portland, Ore. A device particularly adapted for sewer excavation.

No. 644,405. Feb. 27, 1900. Bascule Lift-Bridge. J. P. Cowing, Cleveland, O. The usual segmental bearing surface supported by rollers is relieved of the strain of the live load by means of supports which come into action when the span is thrown down.

No. 644,505. Feb. 27, 1900. Garbage Furnace. Samuel Dixon, Findlay, O. The garbage is supported upon a circulating platform between heat retaining walls and the stack is of peculiar construction for deodorizing the escaping gas.

No. 644,531. Feb. 27, 1900. Open Gravity Filter. Howard Morton, Pittsburg, Pa. (Fidelity Title and Trust company, administrator, same place). The filtering bed is supported midway in a casing with its top open to the air and a chamber formed beneath the bed and having an outlet of great size whereby a vacuum may be produced within the chamber by the sudden withdrawal of water therefrom, thus cleaning the filter bed by the sudden rush of water from above.

No. 644,739. March 6, 1900. Street Sweeper. A. H. Greeley and C. C. Bartlett, Cleveland, O. Specific construction having two diagonally disposed rotary brushes.

Nos. 644,912, 644,913, 644,914. March 6, 1900. A. L. A. Himmelwright, Newark, N. J., assignor to New Jersey Wire Cloth company, Trenton, N. J. Fireproof Construction. Specific arrangements of metallic parts and concrete to produce non-combustible floor construction.

Nos. 644,939, 644,940, 644,941, 644,942. March 6, 1900. Fireproof Constructions. William Orr, Trenton, N. J., assignee to New Jersey Wire Cloth company, same place. Specific arrangements of metallic parts and concrete to produce non-combustible floor construction.

Trade Notes.

ASPHALT.

The Downard Asphalt company, Lima, O., has been incorporated.

The purchase of an asphalt plant is contemplated at Toronto, Ont., and the city engineer has been instructed to report on the cost of a plant. Mayor Macdonald.

BRICK.

The Verdigris Valley Vitrified Brick and Tile company, Neodesha, Kas., has been organized and will build a new plant.

The Chanute Vitrified Brick company, Chanute, Kas., has applied for a charter.

The Pittsburg Coal Mine company, at Amelith, Mich., contemplates the erection of a $50,000 plant in the spring for the manufacture of vitrified paving brick and tile. John C. Werner, Supt.

The Barry Vitrified Brick Works, Atchison, Kas., will be improved and its capacity doubled, at an expense of $13,000.

The Batavia Brick Works, Batavia, O., have been sold at receiver's sale to the First National Bank for $10,500. An effort is being made to reorganize the company.

J. H. Taylor has sold his interest in the Brazil Brick and Pipe company, Brazil, Ind., and the Terre Haute Brick and Pipe company. Mr. Taylor and G. E. Luse, formerly superintendent of the Sheridan Brick Works, have formed a partnership and will establish a plant in Western Missouri or Eastern Kansas.

The Winston Brick and Tile company, Winston, N. C., has been chartered by W. F. Carter and others.

The plant of the Clinton Paving Brick company, Clinton, Ind., was closed March 14 owing to a strike of the employes. The men had been receiving $1.35 a day. This was increased 10 per cent. and one more hour's work per day added, resulting in the strike.

The Beatrice Building and Paving Brick plant, Beatrice, Neb., has been purchased by Robert Klose and John Hampel of Hastings, who will begin operating it soon.

Minneapolis parties contemplate the establishment of a paving brick plant. City Engineer Claussen of St. Paul, who examined paving brick samples made from clay found near Corn creek, pronounces it among the best that he has ever examined and predicts that the establishment of a local plant will revolutionize the paving business in the Northwest.

Higley, Keplinger & Co., 15 Ervin Block, Canton, O., has been organized as a successor to J. L. Higley & Co., brick manufacturers and dealers.

Harry Wales will begin the manufacture of paving brick in April at Nebraska City, Neb.

CEMENT.

The Hurlbut Portland Cement Paving company, Chicago, Ill., has been incorporated to construct concrete work, by S. E. Hurlbut, August F. Witt and W. Harley.

The Hartford Trap Rock Supply company, Hartford, Conn., has been incorporated to quarry stone, buy, sell and deal in cement, sand, etc., by E. S. Goodrich, A. O. Crosby and Charles Crawford.

The Nashville Roofing and Paving company, Nashville, Tenn., contemplates handling hydraulic and Portland cement, hard plaster, sewer pipe, fire brick, terra cotta, etc., and desires prices on them.

The Federal Cement company, incorporated under West Virginia laws, will manufacture Portland cement in Virginia and Tennessee, where it has acquired 25,000 acres of land.

The Great Northern Portland Cement company, East Orange, N. J., has been incorporated to manufacture, sell and deal in Portland and all kinds of natural and other cements. Jas. S. Garvin is interested.

The Imperial Portland Cement company, Nazareth, Pa., has applied for a charter and will erect a cement factory. The incorporators are William H. Parsons, F. H. Banks and M. W. Shafer.

The Kalamazoo Portland Cement company, Kalamazoo, Mich., will erect a cement plant near Cloverdale. Hon. M. H. Lane, Kalamazoo, is interested.

The Monolith Portland Cement company, erect a Portland cement plant at Bristol, Ind. The officers of the company are: Lycurgus McCoy, Battle Creek, Mich.; president; M. H. Lane, Kalamazoo, first vice-presiden; Isaac P. Baldwin, Manassas, Va., second vice-president. Dr. H. T. Harvey, Battle Creek, secretary; George B. Tompkins, Sturgis, Mich., treasurer.

The Yankton Portland Cement company, Yankton, S. D., has put in a new crusher and will double the capacity of its drying apparatus.

Bids are asked until April 7 for furnishing American Portland cement, natural cement and sand at new reservoir. Lieut Col. A. M. Miller, U. S. Engr., 2728 Penn Ave., Washington, D. C.

SEWER PIPE.

The United States Fire Clay plant and the Ohio Sewer Pipe plant at Lisbon, O., have been purchased by Pittsburg and eastern capitalists, headed by R. W. Allison of the Empire Fire Proofing company of Pittsburg, and Henry M. Keasbey, president of the Central Fire Proofing company of New York. The plants have been idle for several years. The price paid was $105,000. The town of Lisbon gave the new owners a bonus of $10,000. Messrs. Allison and Keasbey are negotiating for other fire clay plants in the locality, according to reports.

A charter has been applied for under the laws of New Jersey for the National Sewer Pipe company, which is a consolidation of all the sewer pipe plants east of the Mississippi river. Every firm making pipe in the described territory will be in the company. It will be capitalized at $12,000,000. No stock will be placed on sale and there will be no watered stock, the capitalization representing the actual value of the plants under option. Charles R. Flint of New York is completing arrangements for the trust.

The American Clay Manufacturing company, which has been formed in New York, is reported as having given rise to the rumor that a big combine of manufacturers of special building brick, hollow brick and sewer pipe is being planned. About twenty-five plants will be taken into the new combination, most of which are in Cleveland and Akron, O.

The International Sewage Disposal company, Portland ,Me., has been organized for the purpose of conducting a sewerage disposal business. The officers are: President, O. H. Bragdon, Melrose, Mass.; treasurer, P. S. Young, Dedham, Mass.

PAVING COMPANIES AND MATERIALS.

The Southern Paving Construction company, Chattanooga, Tenn., has been incorporated by H. B. Smith, L. A. Barber, I. C. Jordan, F. M. Staunton and I. N. Smith.

The limestone found in the quarries at Winona, Minn., is said to be well adapted to paving purposes. Similar stone is found at Menominie Falls, Wis., where considerable stone is taken out for paving blocks.

The J. H. Marden Cement and Paving company, La Crosse, Wis., has been incorporated by W. W. Carigil, Mills Tourtellotte and J .H. Marden.

The Miller Paving company, of Memphis, Tenn., has established a branch office in Helena, Ark., with L. F. Douglas as superintendent and contracting agent.

MACHINERY.

The Gates Iron Works, Chicago, Ill., secured the contract for erecting a 75-ton stone crusher at Rockland Lake, N. Y.

The street commissioners of Lewiston, Idaho, were instructed, March 6, to secure prices on road rollers and complete rock-crushing plants. W. Ernest McCullough, cy. engr.

The town of Hiram, Me., voted to purchase three new road rollers. R. N. Lowell, road comr.

O. J. Rees, engineer and land surveyor, Fayettesville, Ark., desires to rent a road roller with a man to run it, to begin work about May 1. Mr. Rees has about 900 yards of surface to roll.

WATER WORKS.

The city of Atlanta, Ga., has brought action in the United States court against the Anniston Pipe and Foundry company, of Anniston Ala., and the Howard-Addison Pipe Works, of Bessemer, Ala., to recover $50,000 damages for extortion claimed to have beeen enforced through the workings of a trust of which defendant companies are alleged to have been members. The bill sets out that in 1895 the complainant purchased certain cast iron pipe and that through the medium of the alleged trust, the plaintiff was compelled to pay a bonus of $6 a ton on all pipe bought. The case will probably be carried to the United States Supreme court.

The O. H. Jewell Filter company, Chicago, Ill., was awarded the contract for furnishing the city of Marinette, Wis., with a filter plant of 3,000,000 gals. capacity.

Newly incorporated water companies: Greenville Water company, Greenville, Tex.; Ruby Water company, Wisdom, Mont.; Water Supply company, Bakersfield, Cal.; Cold Springs Water company, Scranton, Pa.; East Barton Water company, Redland, N. Y.; Canon Ridge Water company, North Ontario, Cal.; Hubbard City Water Works company, Hubbard City, N. Y.; Evergreen Water company, Whittier, Cal.; Crescent Water company, Anderson, Pa.; Corn Hill Water Works company, Cornhill, Tex.; Uvalde Water Works company, Uvalde, Tex.; Farmers' Water company, Burbank, Cal.; Eastberne Water company, Redlands, Cal.

The town of Union, S. C. has placed a contract with the New York Filter Mfg. company, 26 Courtland-st., New York City, for a filtering plant for the town water supply. The city of Morgantown, W. Va., has placed a contract with this firm to increase the New York filter plant already installed in the city.

ELECTRIC LIGHT COMPANIES.

Electric light and power companies have been incorporated as follows: Murray Electric Light and Power company, Monticello, N. Y.

The United Gas Improvement company, which controls all the gas companies in Newark and other sections of New Jersey, has increased its capitalization from $15,000,000,000 to $22,500,000.

IMPROVEMENT AND CONTRACTING NEWS.

PAVING.

Louisville, Ky.—The board of public works and the joint contract committee of the general council have agreed to adopt a new series of asphalt specifications.

Havana, Cuba—Col. Michael J. Dady of Brooklyn, N. Y., will be allowed to carry out his contract for paving the important streets in this city and building sewerage system. The contract was made in 1895 and involves $14,000,000.

Chicago, Ill.—The West Park Commissioners will experiment with creosoted wood block paving at boulevard intersections where the traffic is heaviest, and Engineer Schrader has been instructed to prepare bids for that kind of paving.

Baltimore, Md.—A bill is before the legislature which provides that the mayor and city council of this city be authorized to spend $5,000,000 in paving the streets, the same to be repaid in installments by the property owners where the property is benefited by the paving.

Albany, N. Y.—A bill was introduced Feb. 28 providing for the regulation of contracts for street pavements in New York City. The bill provides that all contracts hereafter awarded shall contain provisions that after the work has been completed the contractor shall maintain the paving in good condition for a period of one year, all paving work shall be finally inspected prior to its acceptance, and if it is found unsatisfactory the city shall proceed to put it in the condition required and shall deduct the cost from the money withheld under the contract.

CONTEMPLATED WORK.

Sparta, Wis.—Paving is proposed for several streets.

Tarrytown, N. Y.—Platt-ave. will be macadamized. Bd. supvrs.

Beardstown, Ill.—Paving is contemplated for a number of streets.

Wyandotte, Mich.—Mayor Roehring is urging the question of street paving.

Hamilton, O.—The question of paving N. Third-st. has been revived.

Delavan, Wis.—Mayor Smith has recommended the paving of the streets.

Portsmouth, O.—Paving is contemplated for Second and Chillicothe-sts.

New Brunswick, N. J.—Resolutions have been passed to pave four streets.

Gainesville, Tex.—This city voted March 13 to issue $5,000 of paving bonds.

Peoria, Ill.—Brick paving is proposeed for 1½ mis. of the East Peoria road.

Avalon, Pa.—This city contemplates constructing about 1 mi. of street paving.

Richmond, Va.—Considerable granite paving is contemplated. W. E. Cutshaw, cy. eng.

Carrollton, Mo.—About $50,000 will be expended for brick paving this spring.

Farmington, Me.—This town has voted to appropriate $6,000 for roads and bridges.

Aurora, Ill.—An ordinance for paving LaSalle-st. with asphalt was passed March 19.

Savannah, Ga.—Brick paving is contemplated for President-st., from E. Broad to Reynolds.

Evanston, O.—Ordinances have been passed providing for brick paving on several streets.

Saginaw, Mich.—Plans and specifications for paving Lapeer-st. have been approved.

Macon, Ga.—A resolution to pave Wall-st. and Washington-ave. with brick was passed March 6.

La Salle, Ill.—Plans have been completed for paving Bucklin-st., from Third to Eleventh.

Bristol, Tenn.—A movement for brick paving on the principal streets has been inaugurated.

Belvidere, Ill.—The city council unanimously voted in favor of paving, March 19. Cy. Engr. Marean.

New Britain, Conn.—The street department contemplates some macadamizing and repairing this year.

Morristown, Tenn.—This county has voted to issue $50,000 of bonds for building a system of turnpikes.

Elba, N. Y.—The village board voted, March 13, to appropriate $1,000 for street improvements, sewerage, etc.

Glenolden, Pa.—Macadam paving is proposed for Scott, Gray's Glenolden, Knowles and Railroad-aves.

San Juan, Porto Rico.—The money furnished this island by congress will be expended in building roads.

Cedar Rapids, Ia.—Considerable macadam paving will be constructed this summer. Cy. Engineer Meredith.

Des Moines, Ill.—(Special.)—Plans for street paving are being made by R. C. Huston, C. E., Chicago, Ill.

Pontiac, Ill.—About 5,200 lin. ft. of brick paving is contemplated this spring. P. C. Knight, Cy. Engr.

Albany, N. Y.—Ordinances have been passed for paving Osborn, Odell and Ontario-sts. and Livingston-ave.

Sheboygan, Wis.—The property owners on Michigan-ave., from Eighth-st. to the lake, want the street paved.

Topeka, Kas.—About 62 blocks of brick and asphalt paving will be constructed this summer. Cy. Engr. Wise.

La Crosse, Wis.—The board of public works has decided to adopt sandstone curbing, according to press reports of March 21.

Durango, Mex.—A loan of $1,500,000 has been negotiated to be used in street paving and constructing a sewerage system.

Denver, Col.—The property owners of Fairview-ave., from Goss-st. to the boulevard, have petitioned for asphalt paving.

Buffalo, N. Y.—The matter of repaving William-st., from Michigan to Jefferson, will be given a public hearing April 19.

Cincinnati, O.—The directors of the cemetery association will improve Spring Grove-ave. with brick for a distance of 1,575 feet.

Jacksonville, Fla.—Resolutions have been passed to pave Newman, Johnson, Liberty, Washington and Cedar-sts. with brick.

Alton, Ill.—Bids will be received May 15 for 20,000 sq. yds. of brick paving on macadam foundation. E. E. Rutlege, cy. engr.

Virginia City, Va.—The street committee has been authorized to receive bids for paving a number of streets with vitrified brick.

Potwin, Kas.—A petition was presented to council March 13, asking that Woodlawn-ave., from Willow to Park aves., be paved.

Urbana, Ill.—Ordinances have been passed to pave Illinois and Elm-sts. with brick on a concrete and crushed stone foundation.

Baltimore, Md.—An ordinance has been

passed to repave Wyoming-st., between Sharp-st. and Crooked-lane, with Belgian blocks.

Owensboro, Ky.—Bids will probably be asked about April 1 for ½ mile brick and ½ mile of asphalt paving. W. P. Small, mayor.

Peoria, Ill.—A petition is being circulated asking that Bradley-ave., from Western-ave. to Saratoga-st. be paved with Novaculite.

Davenport, Ia.—Brick paving is proposed for Harrison, Fourteenth and Farnum-sts. as soon as favorable state legislation is secured.

Washington, D. C.—The district commissioners estimate the cost of the proposed paving of Fourteenth-st. and Lydecker-ave. at $15,000.

La Crosse, Wis.—A new ordinance has been passed for the proposed brick paving in this city. About 40 blocks will be paved. Mayor Anderson.

New Kensington, Pa.—The street committee has instructed the borough engineer to prepare plans for 30,000 or 40,000 yds. of paving.

Moscow, Idaho—(Special)—It is proposed to pave or macadamize Main street, from A to Sixth street. The Commercial club has the matter in charge.

La Crosse, Wis.—An ordinance was introduced, March 19, providing that all new walks must be constructed of stone, brick, asphalt or concrete.

Lima, O.—Bids will probably be received May 1 to 15, for paving three streets with brick and two streets with asphalt. R. H. Gamble, Cy. Engr.

Rock Falls, Ill.—An ordinance has been passed providing for a cement walk on Third-ave., from Second to Fifth-sts. E. C. Winters, Cy. Clk.

Cleveland, O.—A plan to widen and pave Euclid-ave., from East Cleveland township to the county line, a distance of 2½ miles, has been proposed.

Clinton, Ia.—The county supervisors have transferred $12,000 to the road fund, which makes over $20,000 available for road improvements this year.

New Orleans, La.—The council decided, March 21, to reject the bids for paving St. Charles-st., from Canal to Lee Circle, and ask for new bids.

Arlington, N. J.—The board of free holders of Hudson county has voted to grade and macadamize Passaic-ave., from East Newark to the Belleville turnpike road.

Savanna, Ill.—(Special)—An ordinance has been passed providing for building about 2 mis. of cement walks this year. J. P. Plattenburgh, St. Com'r, and Engr.

Kearney, N. J.—Plans and specifications for macadamizing the Passaic river road have been adopted. The estimated cost of the work is $32,581. W. S. Logan, Engr.

Washington, D. C.—Plans have been perpared for the proposed boulevard to run from the Capitol to the site of the proposed memorial bridge across the Potomac.

New Albany, Ind.—A resolution has been passed to pave Market street, from Pearl to State, with vitrified brick. Edward Crumbo, mayor; Thos. M. McCullough, cy. clk.

Grand Rapids, Mich.—Estimates for paving Canal street with brick are as follows: between Bridge and Fairbanks streets, $23,900; between Fairbanks and Coldbrook, $35,000.

Ann Arbor, Mich.—The board of public works recommended March 14 the paving of Huron street, from Ashley street to Fifth avenue with brick at an estimated cost of $2.64 a square yard.

Lincoln, Neb.—An ordinance, creating a new paving district on C. street from Eleventh to Seventeenth, has passed first reading. Brick and asphalt are advocated by the property owners.

Seattle, Wash.—An ordinance was passed March 16 to pave First avenue between Madison and Pike streets, and University street between First and Second avenues, with vitrified brick with granite curbing.

Moline, Ill.—The property owners on Sixteenth street, from Fifth to Eleventh avenues, have petitioned for brick paving. Paving has been recommended for Fifth avenue from Sixteenth to Seventeenth streets. Mayor Wessel.

Ft. Wayne, Ind.—Resolutions were passed March 19 for paving portions of E. Berry, Court, Clinton, Main, Columbia and Wayne streets with vitrified block, asphalt, asphalt block and creosoted block.

Rochester, N. Y.—An ordinance has been prepared for macadam paving on Portland avenue, between Clifford and Norton streets. Ordinances have been passed for paving E. Main street and Joseph and Clinton avenues. Cy. Engr. Fisher.

Crawfordsville, Ind.—A resolution is pending in the city council which provides for brick paving and cement curb and gutter in Washington street from Pike to Market. Certain alleys will also be paved. Cy. Engr. Hoffman.

Philadelphia, Pa.—The bids for vitrified paving on a certain street, the contract for which was awarded to the Philadelphia Contract and Construction company, have been ordered rejected and the work will be re-advertised.

St. Paul, Minn.—The estimated cost of paving Jackson street is as follows: From Third to Fifth, brick, $3.29 per front foot; asphalt, $4.21. From Fifth to Seventh—brick, $2.04; asphalt, $2.60. From Ninth to Grove—brick, $2,86; asphalt, $3.61.

Kansas City, Mo.—An ordinance has been recommended providing for the paving of Thirty-eighth street from Warwick boulevard to Roanoke avenue, with asphalt. An ordinance has also been approved for paving portions of Ninth and Eighth streets with asphalt.

Utica, N. Y.—The city clerk has been authorized to advertise for bids for paving Kossuth-ave. and Bleecker-st. with asphalt. Resolutions to pave Potter-st., from Whitesboro-st. to Potter-ave., and Potter-ave., from Potter to Cedar-st. have been favorably reported.

Brooklyn, N. Y.—Resolutions were adopted March 7 recommending the repaving of Harrison, Van Brunt and Stagg-sts. with granite, and Sackett, De Graw, Summitt and Macon-sts. with asphalt. A resolution was adopted March 13 to widen Meserole-st., from Bushwick-ave. to Union-ave.

New Haven, Conn.—The street committee has recommended vitrified brick paving for Church-st., from Chapel to Sachem. The recommendation for asphalt paving on Temple-st., from Elm to Trumbull, was tabled

March 19, until a report from the committee on appropriations on the bond issue was received and acted upon.

San Antonio, Tex.—It is believed that a plan will be announced soon which provides for paving the business centre of this city and the principal streets leading to the various depots, and the macadamizing of the boulevards radiating from the proposed paved streets in the heart of the city to the thickly settled portions of the city.

Indianapolis, Ind.—Petitions have been filed for paving certain alleys with brick. Final action was taken March 22 on resolutions as follows: Asphalt paving, cement sidewalks and curbing, Talbott-ave., from Twenty-fifth-st. 600 feet north; brick paving and curbing, Washington-st., from Belmont to Warmon-ave.; cement walks in number of streets.

Indianapolis, Ind.—Final action was taken March 15 on resolutions for brick paving in Court-st., from Liberty to Noble; Maryland-st., from Alabama to New Jersey and an alley. A petition was filed March 28 for brick paving in Puryear-st., from Alabama to New Jersey. Final action was deferred on the proposed asphalt paving on Bellefontaine-st., from Massachusetts-ave. to Nineteenth-st.

New York City—Plans have been prepared for asphalt paving in every street in the shopping district of this city. Sixth-ave., from Carmine to Thirty-third-st., will be repaved with asphalt on the present granite block pavement; Fourteenth-st., from Fifth to Sixth-ave., and Thirteenth and Eighteenth-sts., from Fifth to Sixth-ave. will be paved with asphalt. The most important improvement will be Broadway, from Madison Square to Thirty-third-st., which will be paved with asphalt.

CONTRACTS TO BE LET.

Humboldt, Ia.—Bids are asked until April 6 for grading roads. Harwood Sharp, co. audt.

Galion, O.—Bids are asked until April 16 for paving S. Market-st. with brick or block. J. O. Ross, cy. clk.

Dunkirk, N. Y.—Bids are asks until April 13 for macadamizing Griswold and Lion-sts. W. C. Baumgartner, cy. clk.

Sausalito, Cal.—Bids are asked until April 4 for macadamizing Tibuon boulevard. R. E. Graham, clk. bd. supvrs.

Vevay, Ind.—Sealed bids are asked until April 9 for building gravel and macadam roads in Posey township. John F. House, co. audt.

Chester, Pa.—Sealed bids will be received until April 2 for paving and curbing. W. F. Lehman, chmn. com. on sidewalks.

Chillicothe, O.—Sealed bids are asked until April 10 for paving several streets with brick, block or asphalt. H. M. Redd, cy. engr.

Cincinnati, O.—Sealed bids are asked until April 12 for brick paving, curbing, etc., on Hoge-st. Geo. H. Spellmire, clk. B. C. A.

Vermillion, S. D.—Bids are asked until April 3 for grading on the county line between sections 6 and 7. C. W. Trent, co. audt.

Mt. Vernon, Ind.—Bids will be received until April 19 for building 31 miles of gravel or macadam roads. Robt. W. Highman, chmn. co. comr's.

Petersburg, Ind.—Sealed bids will be received until April 3 for building 27 miles and 1,098 feet of rock or gravel road in Washington township.

Huntington, N. Y.—Sealed bids are asked until April 6 for building a highway across Centerport Harbor. C. P. Darling, engr. in charge.

Pontiac, Mich.—Bids are asked until April 13 for about 1,900 sq. ft. of artificial stone sidewalk. E. A. Christian, sec'y Eastern Michigan asylum.

Cleveland, O.—Sealed bids are asked until April 11 for paving Mill-st. with brick and common Medina stone. John Vandervelde, deputy dir. pub. works.

Amsterdam, N. Y.—Bids are asked until April 3 for about 6,000 sq. yds. of asphalt and about 6,000 sq. yds. of brick paving on Division-st. T. I. Haslett, cy. clk.

St. Louis, Mo.—Sealed proposals are asked until April 6 for reconstructing a number of streets with vitrified brick and granite blocks. Robt. E. McMath, Pres't. B. P. I.

Scottsburg, Ind.—Sealed proposals are asked until April 2 for building 15 mis. of gravel or macadam roads in Johnson twp. and until April 4 for 28 9-10 mis. in Lexington twp. C. C. James, co. audt.

Vincennes, Ind.—Sealed bids are invited until April 3 for building 33½ mis. of gravel road in the town of Vigo and 18 mis. in the town of Widner. J. D. Williams, co. audt.

Lewiston, Idaho.—(Special.)—Bids will be received April 15 for 50,000 sq. ft. of macadam paving, and 2,600 lin. ft. of 3 ft. gutter and concrete curbing. Ernest McCullough, cy. engr.

Baltimore, Md.—Bids will be received until April 4 for furnishing sewer and sidewalk brick, granite and asphalt paving blocks, cement, broken stone, etc., during 1900. B. T. Fendall, cy. engr.

Cincinnati, O.—Sealed bids will be received until April 10 for grading and revetment of the slope of the Ohio river bank on the site of the Western pumping station. Aug. Herrman, Pres't. Bd. Trustees, Com'rs. of W. W.

Cohoes, N. Y.—Bids are asked until April 11 for asphalt, block asphalt, brick, block or granite paving and curbing on Congress, Saratoga, Lancaster, Hart, Newark, Howard, Canvass and Pine-sts. Wm. J. Elliott, Clk. Pub. Imp. Com.

Williamsport, Pa.—Sealed proposals are asked until April 12 for repaving 13,050 sq. yds. of W. Fourth-st. with brick or asphalt; laying 4,975 sq. yds. of brick or asphalt on old macadam foundation on E. Third-st.; about 3,000 sq. yds. of asphalt on Campbell-st. Geo. D. Snyder, Cy. Engr.

Rumford Falls, Me.—Sealed bids are asked until April 20 for extending the Low canal. The work will include a cofferdam, consisting of 38,000 cu. yds. excavation, of which 20,000 cu. yds. will be made into a rolled embankment; about 4,000 sq yds of slope paving. Chas. A. Mixer, resident engr. Rumford Falls Power company.

CONTRACTS AWARDED.

Champaign, Ill.—J. W. Stipes of this city secured the contract for repaving Mill-st. for $4,210.

Carthage, O.—The contract for extending Third and Fourth-sts. was awarded to F. Dracker for $5,669.

Grand Rapids, Mich.—The contract for

cement curb in Sweet-st. was awarded March 16 to L. C. Snyder for $2,025.

Bay City, Mich.—Hugh Campbell secured the contract for paving Third-st., from Water to Jackson, with brick, for $16,010.

Clinton, Ill.—The contract for brick paving was awarded March 10 to John Betz & Son of Springfield for about $3,000.

Wellsville, N. Y.—Mahoney Bros. & Gardner, Jamestown, N. Y., secured the contract for paving Main-st. with brick for $23,436.

Chattanooga, Tenn.—The Barbar Aspha Paving company, New York City, secured the contract for repaving Market-st. with brick for $7,431.

Texarkana, Ark.—The contract for street paving was awarded to Ward & Ockandre of Little Rock for $60,385, according to press reports.

Redlands, Cal.—The contract for paving Orange-st. with asphalt was awarded to the Alcatraz Paving company of Los Angeles at 24⅝ cts. a sq. ft.

Boston, Mass.—The contract for building about 6,000 ft. of road of the Winthrop Shore reservation has been awarded to Patrick McGovern of Roxbury for $34,538.

Toledo, O.—Paving contracts have been awarded as follows: Hicks-st., granite, H. G. Jennison, $24,711; Prouty-ave., Nelsonville block, Garrigan Bros., $13,203.

Racine, Wis.—The Reichert Construction company secured the contract for grading Washington-ave., from Asylum-ave. to Twelfth-st., at 25 cts. per cu. yd.

Lakewood, O.—Thos. H. Garland & Sons of Cleveland secured the contract for building Clifton boulevard, for about $100,000, according to press reports.

Cincinnati, O.—The contract for improving Clifton-ave., between canal bridge and Mill creek, with crushed stone, has been awarded to John Ryan at his bid of $417.

Philadelphia, Pa.—The contract for paving bicycle path and gutters in Fairmount Park with brick during 1900 has been awarded to the Philadelphia Construction company at $1.60 a sq. yd.

Philadelphia, Pa.—The contract for repairs to paved streets was awarded March 16 to the Mack Paving company, for $334,950, and for repairs to country roads to Daniel J. McNichol for $159,900.

Trenton, N. J.—John Sinkhorn & Co. submitted the lowest bids for road work in Mercer county, as follows: Manalapan road, $12,800; White Horse-Crosswick's road, $24,939; Edinburg-Hightstown road, $44,824.

Morgan Park, Ill.—(Special.)—R. C. Huston & Co., Chicago, submitted the lowest bid, March 20, for 4,800 sq. yds. of brick paving and 3,000 lin. ft. of concrete curb and gutter at $8,630. D. V. Roberts, Engr.

Newport News, Va.—The lowest bidders for paving the principal streets of this city were as follows: Waring & Co., city, vitrified brick, $2.33 a sq. yd.; Cleveland Trinidad Paving company, sheet asphalt, $2.83.

New Orleans, La.—Bids were received March 5 for paving Prytania-st., from Philip to Louisiana-ave., with asphalt, as follows: Barber Asphalt Paving company, $2.90 a sq. yd.; Louisiana Improvement company, $2.64; Harry C. Spinks, $2.59.

Indianapolis, Ind.—Contracts were awarded March 21, as follows: Cement walks—Harland-st., T. P. Fall, 38 cts. a lin. ft.; Fourteenth-st., P. E. Phillips, 47 cts. for 4 ft. and 35 cts. for 3 ft. walks; Capitol-ave., W. C. Alton, $1.30.

Erie, Pa.—Bids were received March 19 for repaving State-st., but the awarding of the contract was deferred until March 29. The contract for curbing Parade-st., between Fourth and Fifth, was awarded to Thomas Paskett at 47 cts. a lin. ft.

Scranton, Pa.—The Barber Asphalt Paving company submitted a bid, March 15, for paving Costello Court with asphalt, as follows: standard sheet asphalt on 4 in. concrete base, $2.25 a sq. yd.; curbing, 55 cts. a lin. ft.; circular curb, $1.10 a lin. ft., resetting curb, 10 cts. a lin. ft.

Cleveland, O.—The contract for draining, grading and improving the new Edgewater parkway, from Taylor-st. to Edgewater parkway, was awarded to the Northern Ohio Paving and Construction company for $129,092, and for draining and improving the new Woodland Hills park to Thomas H. Garland & Sons for $35,052.

Sandusky, O.—Bids were received March 7 from seven contractors for paving N. Depot-st. with asphalt block, asphalt or brick. The contractors bidding were the Warren-Scharf Paving company, Ayers Asphalt Paving company, Cleveland Trinidad Paving company, Charles F. Hartman, Beaver Falls Paving company and G. O'Donnell.

Woodbury, N. J.—Contracts for constructing roads were awarded, March 15, as follows: 6½ mls. macadam road in Bridgeport, Delaware Granite and Mining company., Wilmington, Del., $22,181; 4⅞ mls. gravel road on Glassboro and Clayton road, J. S. Fisher, Clayton, $6,842; Mullica Hill and Harrisonville road, B. F. Sweeten & Son, Camden, $6,446.

Chicago, Ill.—Bids were opened, March 14, for street improvements. The asphalt bids were particularly low, the Barber Asphalt Paving company bidding $1.90 a sq. yd. for asphalt paving for a system of streets in Hyde Park. Joseph Duffy bid $1.93 for paving Adam-st., from Center to Western-ave. with asphalt. The granite bids ranged from $3.35 to $4; brick from $1.87 to $2.20; macadam, $1 to $1.30.

Wilkesbarre, Pa.—Bids were received March 17 for paving portions of five streets with Clearfield brick block on sand and gravel foundation as follows: Fred Hendler, $1.24 a sq. yd.; Corns & Donahue, Kingston, Pa., $1.29½; D. M. Rosser, Kingston, $1.31; Gibbons & Co., $1.35; Yagle & Glick, $1.32; Kuss & Co., $1.43. The contract was awarded to Fred Hendler at $1.24, and the curbing contract to Dennis Buckley at 52 cts. lin. ft.

Wyandotte, Mich.—The only bid submitted March 14 for paving Biddle-ave. was by B. D. Bartow of Port Huron, and was as follows: Excavating and removing earth, 30 cts. a cu. yd.; Medina curb, 55 cts. lin. ft.; Elyria curb, 50 cts.; cedar paving on concrete, $1.30 a sq. yd.; Nelsonville brick on concrete, $1.50; block asphalt on concrete, $2.25; block asphalt on gravel, $2.35; block asphalt on crushed stone, $2.30. The award of the contract was deferred.

New Haven, Conn.—Bids were received March 20 for furnishing brick for the E. Chapel-st. paving. The New York Brick and Paving company and the Mack Manufacturing company bid respectively on Syracuse, Catskill and wire-cut brick at

prices averaging $13.50, $14.50 and $18.50 per 1,000. Bids were also received for constructing the paving from J. A. Doolittle and Wright & Turner of Mt. Vernon, N. Y.; Lawrence O'Brien, Thomas F. Maher and Abbot, Gamble & Co. of New York City; C. W. Blakeslee & Sons, New Haven.

Buffalo, N. Y.—Bids were received March 6 for paving Howell-st. and repairing W. Huron, Seventh, William and Chestnut-sts. and Massachusetts-ave. The bids were on asphalt and brick. Bids were received March 15 for repair work on asphalt pavements as follows: H. P. Burgard, surfacing, $1.53 a sq. yd.; skimming, $1.53; replacing concrete and asphalt surface, $2.55; scraping joints and coating gutters, 5 cts. a lin. ft.; cleaning out cracks and smoothing, 3 cts. a lin. ft.; replacing stone along street railway tracks and making connections between stone and asphalt, 25 cts. a lin. ft. German Rock Asphalt company, $1.57, $1.05, $2.75, 4 cts., 2 cts, and 21 cts., respectively. Barber Asphalt Paving company, $1.53, $1.01, $2.43, 4 cts., 2 cts. and 19 cts., respectively.

Atlanta, Ga.—Bids were received March 19 for paving three streets, as follows: Warren-Scharf Asphalt Paving company, Cincinnati, asphalt, Whitehall-st., $2.84; Peters-st., $2.91; Nelson-st., $2.91. Southern Paving and Construction company, Chattanooga, Tenn., asphalt, Whitehall-st., $2.77; Peters-st., $2.83. W. S. P. Shields, Philadelphia, asphalt, Whitehall-st., $3.63; asphalt on present granite block, $2.63; Peters and Nelson-sts., $3.63. Tennessee Paving company, Chattanooga, brick; Whitehall-st., $2.67; Peters-st., $2.59; Nelson-st., $2.64. John W. Sibley, Birmingham, Ala., brick, Whitehall-st., $2.69; Peters-st., $2.62; Nelson-st., $2.69; if five-year guarantee is given 26c less per sq. yd. John Bradley, Atlanta, granite; Whitehall-st., $1.79; Peters-st., $1.91; using old stone, $1.84; Nelson-st., $1.79.

Chicago, Ill.—Contracts have been awarded as follows: John P. Agnew, brick paving, Aberdeen-st., N. Forty-first, Court and S. Sangamon-st. South Chicago Teaming company, macadamizing Avenue H. James A. Sackley, cedar block paving S. Carpenter-st. and three alleys. Gaffney & Long, brick paving S. Clinton-st. and S. Center-ave. and macadam in N. Clinton-st. James Conlan, macadam Calumet-ave. and Fifty-eighth-st. Smith, Moss & Brown, cedar blocks S. Clinton and N. Rockwell-sts. James Lyman & Co., macadam N. Forty-third-st., Aldine-ave. and N. Forty-first-court. James Bairstow & Co., macadamizing Lafayette parkway. R. F. Conway & Co., cedar blocks W. Monroe-st., a system of streets and two alleys; granite blocks W. Van Buren-st., vitrified brick W. Van Buren-st. C. M. Netterstrom, vitrified brick, a system of streets. D. A. Thatcher, macadam, a system of streets.

SEWERS.

Trenton, N. J.—The Passaic pollution bill was passed March 20. The bill is permissive and cannot become operative until it is approved and the terms accepted by the governing bodies of the municipalities included in the proposed sewerage districts.

Worcester, Mass.—Suit was filed against the city March 15 for $10,000 damages, the result of quicksand encountered in the construction of the separating systems of sewers. The plaintiff claims that the walls of her building have settled and are cracking on account of the settling in the immediate vicinity.

Jersey City, N. J.—The first act of the state sewerage commission, acting under the new law defining its powers, was to instruct the secretary of the board, Boyd McLean, to send immediately to each of the municipalities which empties its sewage into the Passaic or its tributaries a notice requesting it to furnish the sewerage commission with information as to how much time it will require to make plans for otherwise disposing of its sewage matter.

CONTEMPLATED WORK.

Keithsburg, Ill.—A sewerage system is proposed.

La Crosse, Wis.—A sewer is proposed for State-st.

Santa Barbara, Cal.—A sanitary district will be formed.

Fishkill, N. Y.—Plans have been completed for a sewerage system.

Concord, N. H.—This town has voted to expend $165,000 for sewers.

Madelia, Minn.—Bonds have been voted for a sewerage system.

Wabash, Ind.—Sewers have been petitioned for in Maple and Carroll-sts.

Logansport, Ind.—A petition has been circulated asking for a sewer.

Conneautville, Pa.—The question of a sewerage system is being agitated.

Wilmington, Del.—A sewer is proposed for Pennsylvania-ave. and Dupont-st.

Newport, Pa.—Bids will be asked for soon for a sewerage system. P. C. Morrow.

Delavan, Wis.—Mayor Smith has recommended the extension of the sewerage system.

Vineland, N. J.—This town voted March 13 to issue bonds for a sewerage system.

Swampscott, Mass.—The question of building sewers has been postponed for one year.

Walla Walla, Wash.—(Special.)—The council will consider sewerage disposal soon.

Jamestown, N. Y.—The question of extending lateral sewers will be voted on April 3.

Aberdeen, Wash.—The council has taken up the subject of building a sewerage system.

Winnipeg, Man.—Bids will be asked for a sewer in Burrows-ave., from Main to Aikens-st.

Hampton, Ia.—This town has decided to build a sewerage system. T. J. Robinson.

Bar Harbor, Me.—This town has voted to build a sewer in Cottage-st. F. L. Brown, Chmn.

Decatur, Ind.—(Special.)—The board of county commissioners will ask bids soon for sewerage.

Portage, Wis.—The question of constructing a sewerage system will be voted on April 3.

Lafayette, Ind.—A petition will be circulated proposing a sewerage system on the West Side.

Minneapolis, Minn.—The council committee ordered, March 13, $22,000 worth of sewers.

Evanston, Ill.—A 12-in. sewer in Lincoln-ave. is contemplated at a cost of $1,000.

Rock Falls, Ill.—The question of building a sewerage system is being agitated by the press.

Madison, Me.—The sum of $1,800 has been appropriated for a sewer. W. L. Remick, Chmn.

Merced, Cal.—The construction of a sewerage system is contemplated. H. H. Henderson, Engr.

Springfield, Ill.—A petition has been filed for a sewer on Seventh-st., from Vine to Spruce.

Wheaton, Ill.—(Special.)—George I Herrick says the sewer question is still unsettled.

Morris, Minn.—The question of isuing $25,000 of bonds for a sewerage system will be voted on.

Salem, O.—Council has been petitioned to build 2,000 ft. of 8-in. sewer in E. Sixth-st.

Ballston Spa, N. Y.—Plans are being made for a sewerage system. H. M. Geer, Vil. Engr.

Framingham, Mas.—The sum of $10,000 will be expended on a new trunk sewer in South Framingham.

Omaha, Neb.—Contract will be let soon for the North Omaha main sewer; estimated cost, $50,000.

Easthampton, Mass.—The town board has recommended a new sewerage system at a cost of about $11,160.

Winona, Minn.—The city council adopted, March 19, the report for the proposed second sewerage system.

Rahway, N. J.—The State sewerage commissioners have approved the plans for sewer extension in this city.

Graceville, Minn.—Bids will be asked soon for building a sewerage system. M. F. Noonan, mem. sew. com.

Lansdowne, Pa.—An ordinance has been passed providing for plans and specifications for a sewer to tidewater.

Marion, Ind.—An ordinance has been passed appropriating $45,000 for sewers and street improvements.

Altoona, Pa.—Ordinances have been passed providing for sewers in certain streets and alleys.

Newport, Ky.—Bids will be desired about July 1 for brick and pipe sewers. B. R. Morton, cy. engr.

Whitesboro, N. Y.—This village has voted to borrow from $35,000 to $40,000 for building a sewerage system.

Oklahoma City, Okla.—Mayor Van Winkle advocates an issue of bonds for buildnig an extensive sewerage system.

Ottumwa, Ia.—Plans and specifications are being prepared for a sewerage system in South Ottumwa. J. T. Brady, cy. engr.

Owensboro, Ky.—Bids will be asked about April 1 for about three miles of 24-15 inch pipe sewers. W. P. Small, mayor.

Columbia, Mo.—Estimates for the proposed sewerage system will be made by Hiram Phillips, C. E., of St. Louis.

Sheboygan, Wis.—The board of public works was authorized March 21 to advertise for bids for about three miles of sewer.

Bellefontaine, O.—The question of issuing $30,000 bonds for a sewerage system will again be submitted to vote April 2.

Tacoma, Wash.—Plans are being prepared for a system of sewers to drain the factory district at the head of the bay.

Washington, D. C.—The district commissioners have ordered a number of sewers constructed under the assessment system.

Wellsville, O.—The sewer committee has been authorized to advertise for bids for a storm water sewerage system.

Brookfield, Mo.—Bids will be asked for soon for building sewers in districts Nos. 1, 4 and 9. Hiram Phillips, engr., St. Louis.

Canton, O.—A resolution has been passed to build a sewer in Cassilly-st., from W. Third to Elizabeth. Louis L. Ley, cy. clk.

Saulte Ste. Marie, Mich.—City Engineer Lawnes' recommendations for the improvement of the sewerage system have been approved.

Oakland, Cal.—Plans for the annex sewer district have been completed by City Engineer Clement. They provide for 45 mis. of sewers.

Marshalltown, Ia.—The council is consiging the report of G. E. Hill of New York City for an extensive sewerage disposal system.

New York City.—The bill giving this city authority to construct sewage disposal plants has been signed by Governor Roosevelt.

Albany, N. Y.—Plans are being prepared for a sewer in Albany Basin. A pipe sewer 7,200 ft. long will be built in Livingston-st.

New Orleans, La.—The cost of an open canal along Toulouse-st. is estimated at $20,000 and of a lined canal at $85,000 to $100,000.

Richmond, Va.—Bids will be received soon for 2,000 ft. of sewer to extend from Tobacco-st. through Hollywood Cemetery.

Terre Haute, Ind.—A petition has been filed with the board of public works for a sewer in S. Center-st., between Washington and Hulman.

Wahpeton, N. D.—A resolution has been adopted providing for a sewerage system in that portion of the city south of Dakota-ave.

Rawlins, Wyo.—The question of issuing $25,000 bonds for a sewerage system will be voted on. The plans and specifications have been prepared.

Suffolk, Va.—Estimates are desired for a topographical survey preparatory to building a general sewerage system. W. B. Ferguson, chmn. spec. com.

Caracas, Venezuela.—About $1,800,000 will be expended for building a sewerage system and street paving, according to press reports.

Pasadena, Cal.—The question of issuing $178,400 bonds to complete the sewerage system will be voted on April 11. W. B. Clapp, Cy. Engr.

Sewerage systems are contemplated at the following places: Holland, Mich.; Monteagle, Tenn.; Savanna, Ill.. Valley Junction, Ia.; Elba, N. Y.

Newark, N. J.—The city council and the city surveyor have been instructed to proceed with preparations for building the central relief sewer.

Dayton, O.—An ordinance has been passed to build a main sewer with lateral sewers and sewage lift for sewer district No. 9. John A. Hahne, Cy. Clk.

Hartford, Conn.—A resolution has been passed authorizing the extension of the south branch of the intercepting sewer; estimated cost $35,000.

Hazleton, Pa.—Contracts will be let the latter part of April for sewer work to cost about $2,500 and about July 1 for sewer work to cost $22,000.

Marquette, Mich.—Mayor Neidhart has suggested that a trunk sewer be built along Lake-st. to Whetstone brook, taking in the other sewers in its course.

Chicago, Ill.—Specifications have been prepared for building section L of the South Side intercepting sewer, which will be 515 feet long and 20 feet in diameter.

Duluth, Minn.—Plans and estimates for a sanitary and storm water sewerage system for West Duluth have been prepared by City Engineer McGilvray; total estimated cost $339,713.

Erie, Pa.—The city engineer has been directed to prepare estimates of the cost of building a main sewer in the Lake Road, Pennsylvania, McCarter and East-aves., from Light House run to Twelfth-st.

Philadelphia, Pa.—A bill has been passed authorizing the construction of various main sewers at a cost of $300,000, including a sewer to relieve the Cohocksink sewer, at a cost of $100,000.

Vicksburg, Miss.—The legislature has authorized the city to issue $100,000 in bonds for the purpose of building a sewerage system. For information in detail address James M. Searles, C. E.

Edison Park, Ill.—(Special.)—Surveys for a complete sewerage system for this village are being made by R. C. Huston of Chicago. The outlet will flow into the north branch of the Chicago river.

Columbus, O.—A bill was introduced March 15 to create a board of sewer commissioners for the city to carry out the Alvord plan for completing the sewerage system and erecting a sewage disposal plant.

Springfield, Mass.—The committee on sewers have asked for $170,000, about $100,000 of which is wanted for two trunk sewers, the Mill river sewer, and one which will be practically an extension of the Mill river sewer.

Williamsport, Pa.—Sectional plans and estimates have been epared for a sewer on Locust-st. for the r ef of Grafins run. One section will be 4,000 et long with a conduit 11 feet in diameter v h a brick rim 16½ feet thick.

Jamaica, (L. I.) N. Y.—The bill permitting New York City to build a sewage disposal plant for this place has become a law and it is believed that work will begin at once. The pipe system was built several years ago. The estimated cost of the disposal plant is $60,000.

Buffalo, N. Y.—The construction of new sewers on the east side is urged. The rebuilding of the Sycamore-st. brick sewer is proposed at a cost of $55,000. Plans have been approved for the abatement of the sewage nuisance in connection with the abandonment of the Hamburg canal. A siphon to transfer the sewage from the Hamburg canal to the Niagara river is being considered.

CONTRACTS TO BE LET.

Seymour, Ind.—Bids are asked until April 5 for a 12-in. pipe sewer. L. E. Jennings, cy. clk.

Ferndale, Cal.—Bids are asked until May 1 for a sewerage system. A. Bordine, prest. bd. trustees.

Grand Forks, N. D.—Bids are asked until April 2 for changing sewer and water pipes. William Ackerman, chrmn. com. on w. w.

Elizabeth, N. J.—Bids are asked until April 2 for 800 ft. 12-in. pipe sewers, 52 6-in. connections, etc. St. Comr.

Toledo, O.—Sealed proposals are asked until April 2 and 16 for constructing cylindrical pipe and brick sewers. William O. Holst, cy. clk.

Washington, D. C.—Sealed bids are asked until April 11 for an addition to the sewerage system at the Genoa Indian school, Nebraska. W. A. Jones, comr. Indian Affairs.

Boston, Mass.—Sealed bids are asked until April 7 for building sections 70, 71 and 75 of the high-level sewer in West Roxbury and Roxbury. William M. Brown, jr., ch. engr. Met. Sewerage Comrs.

Manhattan, Kas.—Sealed bids are asked until April 2 for building a sewer 8,000 ft. long, from the college building to the Kansas river. E. R. R. Nichols, acting prest. Kansas State Agr. College.

Chicago, Ill.—Sealed bids are asked until April 16 for constructing foundations for four arch culverts and for constructing fourteen pipe culverts under the Illinois and Mississippi canal. J. Willard, major engrs., or L. O. Wheeler, const. engr., Rock Falls, Ill.

Jersey City, N. J.—Sealed bids are asked until April 3 for constructing 2,479 ft. of 36 and 30-in. brick sewers and 3,120 ft. 54 and 36-in. cast iron pipe sewers in the Hudson City main sewer district; also 395 ft. of 54, 66 and 42-in. brick, 390 ft. special brick, including concrete cradle; and 220 ft. 70-in. steel pipe sewer in Swampy Creek. Jas. S. Nelson, chrmn. com.; G. T. Bouton, clk. st. & water comrs.

CONTRACTS AWARDED.

Redlands, Cal.—E. Frenzell secured the contract for the extension of the E. State-st. sewer.

Augusta, Ga.—M. J. Hollahan was the lowest bidder for laying 4,580 ft. of 12-in. pipe at $8,453.

Dubuque, Ia.—J. B. Miller was awarded the contract March 15 for the Cooler creek stone arch sewer for $11,620.

Canton, S. D.—The contract for sewer work has been awarded to Jos Kehoe of Des Moines, Ia., for $2,781.

Cleveland, O.—The contract for building a sewer in Muirson-st. has been awarded to Nicholson & Co. for $53,000.

Walla Walla, Wash.—The contract for constructing 23 mls. of sewers was awarded to the G. H. Sutherland company for $38,900.

Wellsville, O.—The contract for building a sewerage system has been awarded to Irwin Bros. of Greenville, O., for $56,100.

Indianapolis, Ind.—Sewer contracts were awarded March 15 to Wm. Smith & Co., at 79 cts., and Matt Matthews, at 74 cts. a lin. ft.

Detroit, Mich.—Contracts for lateral sewers were awarded March 19 to W. H. Whittaker, John Jeynes and Wm. Porath.

Roswell, N. Mex.—The contract for constructing a partial sewerage system was awarded to Matt & Roberts of Independence, Mo., for $25,000.

Chambersburg, Pa.—A franchise to construct a sewerage system has been granted to Col. Jared E. Lewis and Robert L. Forrest of Philadelphia for $75,000.

Chicago, Ill.—The bids received recently for sewer and house drain contracts ranged from 75 to 400 per cent. higher than those received eighteen months ago. They were rejected.

Grand Junction, Col.—The contract for the construction of 13 mls. of sewers in two districts was awarded March 12 to the Geddis & Seerie Stone company of Denver at $12,134 and $40,569, respectively.

Denver, Col.—John Callaghan was awarded the contract for sewer work in the two sub-districts of Capitol hill storm sewer district, No. 1, as follows: Dist. No. 18, $10,322.14; dist. No. 22, $17,408.62.

New York City—Bids were received March 21 for building sewers in portions of Eighty-sixth-st., First and Second-aves. and Bay Ridge parkway, from seven contractors. The bid of Wm. Downey, 740 Jefferson-ave., $46,733, was recommended for award.

Sherman, Tex.—A franchise has been granted to J. P. Withers of this city, Andrew Rosewater of Omaha, Neb., and associates to construct, equip and operate a sewerage system for a term of 50 years, reserving to the city the privilege of purchasing the same at any time after one year. Estimated cost of plant, $100,000.

Brooklyn, N. Y.—The contract for the Ft. Hamilton sewer was awarded to O'Brien & Sheehan for $396,000. The sewer will be four miles long. Bids were recommended for award March 14 as follows: Seventy-first, Seventy-second, Seventy-third and Seventy-fourth-sts. and Second-ave., William F. Norton, New York City, $22,849; Fifth-ave., Eighty-fourth and Eighty-fifth-sts., James Jennings, $9,302.

Pittsburg, Pa.—Sewer contracts were awarded March 10 as follows; Pollard alley, Flavian-st. and Spruce alley, Sweeney & Houston; Centera-ave, Evan Jones; Cherokee, Fox and Grant-sts., Thomas Prosser; Duncan-st., Keeley & Ridge; Edna, Greeley, S. Twenty-eighth and Keystone-sts. and Lang-ave., Ott Bros.; Gettysburg-st., Cronin & O'Herron; Horton and La Place-sts., James McQuade; Wilkins-ave., Booth & Flinn. The cost of the sewers aggregates $75,000.

Norwood, O.—Bids were received March 17 for building sewers in district No. 1, subdistrict No. 1, the work to consist of 19,900 ft. of 15 6-in. pipe sewers, 105 manholes and 14 flush tanks. The bids were as follows: A. J. Henkle & Bro., $15,489; T. J. Walsh, $15,034; George Douglas & Co., $18,195.30; McCarthy Bros., $14,508; Louis Drach Construction company, $18,749; Thomas B. Strack, $18,606.50; Van Standt & Meeds, $17,162.30; John B. McLane, Newport, Ky., $15,936.10.

WATER-WORKS.

Omaha, Neb.—Municipal ownership of the water works was carried by a large majority at the recent election.

Dubuque, Ia.—This city voted to accept the water company's proposition to sell its plant to the city for $545,000.

Vineland, N. J.—This city has voted to purchase the city water supply plant from Chas. Keighley & Sons for $80,000.

Utica, N. Y.—A new bill has been introduced in the legislature which provides for municipal ownership of a public water supply.

Rensselaer, N. Y.—Governor Roosevelt decided, March 5, to give the Greenbush Water company until Jan. 1, 1901, to improve its system, and if it fails to do so the city will repudiate its water contract and obtain a new supply.

Elgin, Ill.—The water works standpipe collapsed March 14. Ice is believed to have caused the accident. The capacity of the tank was 525,000 gals., and it was practically full at the time of the accident.

Chester, Pa.—Suit has been begun against the New Chester Water company to compel it to give a more wholesome water supply. It is claimed by the citizens filing the suit that the water is contaminated by the city sewage.

Los Angeles, Cal.—Suit was filed by the West Side Water company, March 15, against this city and the members of the council to have the ordinance fixing water rates declared void and of no effect in so far as it concerns the plaintiff.

New York City—An attempt was made at Albany, N. Y., March 20, to procure legislation enabling New York City to own its own water supply. A delegation representing the water supply committee of the Merchants' Association of New York City, appeared before the Senate Cities Committee and urged action on the Ford bill, which is identical with the Morgan bill. Both bills purport to restore to that city the privileges which were taken from it in the new charter, and prior to the enactment of which New York City had the right of eminent domain. The new charter limited those rights.

CONTRACTS TO BE LET.

La Grange, Tex.—Bids are asked until April 4 for the removal of the La Grange Water Works. Mayor.

Hubbard, Tex.—Bids are asked until April 2 for building water works. W. R. Bounds, sec'y. City Water company.

Woodland, Cal.—Bids are asked until April 3 for boring a number of 8 and 10 in. wells. J. G. Frederick, chmn. bd. supvrs.

Cincinnati, O.—Bids are asked until April 16 for furnishing water pipe, special and loam castings. Geo. H. Spellmire, clk.

Idaho Falls, Idaho.—Bids will be received until April 27 for the completion of the water works. Jos. A. Clark, chmn. water bd.

Chicago, Ill.—Sealed bids are asked until April 4 for laying water supply pipes on ten streets. L. E. McGann, pres't. bd. local imp.

Washington, D. C.—Sealed proposals are asked until April 10 for furnishing and installing one centrifugal and two air lift pumping plants. A. M. Miller, lt. col engrs.

Lafayette, Ind.—Bids will be received until April 17 for sinking 16 tubular wells, which will be supplemental to those now in use. Messrs. Southworth and Fletemeyer, bd. W. W. trustees.

Parkersburg, W. Va.—Bids are asked until April 3 for a mechanical filter plant of 2,500,000 gal. capacity, and a filtering crib of 3,000,000 gals. capacity. C. H. Turner, engr.

CONTRACTS AWARDED.

Reading, Mich.—T. C. Brooks & Co., Jackson, Mich., secured the contract for building a water works system in this city.

Gallatin, Tenn.—Rosser & Castoe, Bellaire, O., secured the contract for a water works system in this city for $40,000.

Cedar Rapids, Ia.—A franchise for the new water works system was granted to John H. Brown of Chicago, March 12, for $500,000.

Fossil, Or.—The contract for building a water works system has been awarded to Jos. Pacquet and C. E. Bade of Portland, Or., for $10,800.

Cincinnati, O.—The lowest bid submitted for grading and excavating at the California water works plant was that of A. S. Henkel at $140,247.

Augusta, Ga.—M. J. Hallahan & Co. secured the contract for laying about 4,580 ft. of 12 in. water pipe on four streets for $8,543.

Cape May, N. J.—A franchise was granted to J. Pemberton Newbold, March 6, to lay mains and establish salt or sea water works in all streets of this city.

Douglaston, N. Y.—The contract for laying the pipes from the Flushing pumping station to this town and Little Neck has been awarded to Stewart M. Neff of Manhattan.

Alton, Ill.—The Seckner Contracting company, Chicago, offered to build the water works system for $252,600. This company's bid was the only one received March 17.

North Braddock, Pa.—The Pennsylvania Water company awarded a contract, March 16, to W. F. Boysen of Buffalo, N. Y., for constructitng a 13,000,000 gal. reservoir in this town, for about $200,000.

Essex Junction, Vt.—The contract for laying water mains, building a dam at the springs and constructing a storage reservoir for the new water works was awarded to C. N. Taylor of Clinton, Mass., for $8,619.

Philadelphia, Pa.—Contracts were awarded, March 13, as follows: Holly Mfg. company two triple expansion pumps of 10,000,000 gals. each, $51,200; Walker & Kepler, two engines, $1,000 each, and two electrical generators, $954.40; Robert Wetherell & Co., four boilers, $4,750 each; Palmer & Queen, conduits and pumping well, at Queen Lane reservoir, $53,000.

Cleveland, O.—Bids were received, March 17, for furnishing pumping engines of 20,000,000 and 25,000,000 gals. capacity, as follows: 20,000,000 gal. engine—Holly Mfg. company, $151,600; E. P. Allis & Co., $147,000; Blake Mfg. company, $146,000; Worthington company, $119,000. This pump is to be placed in the Division-st. pumping station. The other pumps are to be placed in the new station and are as follows: E. P. Allis & Co., two engines, $165,000 each; four engines, $165,250 each; Holly Mfg. company, two engines, $156,600 each; four, $154,900 each; Blake Mfg. company, two, $156,000 each; four, $154,000 each; Camden Iron Works, two, $134,500 each; four, $129,500 each.

CONTEMPLATED WORK.

Quinnesec, Mich.—A new system of water pipes is proposed.

Evansville, Ind.—A plan for filtration will be formulated.

Lubec, Me.—Arrangements will be made at once to complete the water works.

Boulder, Col.—Plans have been adopted for increasing the water supply.

Neenah, Wis.—The introduction of water meters is suggested by the press.

Sistersville, W. Va.—Bonds have been voted for extending the water work.

Mapleton, Minn.—Bonds have been voted for improving the water works system.

Lincoln, Neb.—The question of improving the water supply is being considered.

Hudson, N. Y.—The question of introducing water works meters is being considered.

Toledo, O.—The water works board has decided to extend the 12-inch main to Ironville.

Hartford, Conn.—The water commissioners decided March 13 to introduce water meters.

Bridgewater, Mass.—The purchase of the plant of the Bridgewater company is proposed.

Reading, Mass.—This town voted to extend the water mains; estimated cost, $11,000.

Ottumwa, Ia.—Plans are being prepared for a new water works system. J. T. Brady, cy. engr.

Philadelphia, Pa.—An independent pipe line and pumping plant has been suggested for fighting fires.

Pasadena, Cal.—Estimates are being prepared for a municipal water system. W. B. Clapp, cy. engr.

Weymouth, Mass.—The sum of $3,000 has been voted for water mains and $5,000 for hydrants.

Washington, D. C.—The district commissioners have ordered water mains laid in certain streets.

Ithaca, N. Y.—The question of municipal water works will be considered. C. C. Platt, cy. clk.

Lima, O.—The question of extending the water works will be voted on April 2. C. E. Lynch, cy. clk.

Memphis, Tenn.—About twenty-five miles of water mains will be laid this year. L. Simpson, secy. water company.

Jackson, Mich.—The question of issuing bonds for an increased water supply will be voted on April 2.

Bloomfield, Ind.—Bids will be asked soon for a franchise to furnish water and electric lights.

Marion, Ind.—The water works board decided March 19 to put in a 4-in. water main on Adams and Swayzee-sts.

Moline, Ill.—The city council decided March 9 to proceed with the plans for a new water works system.

Monroe, La.—A committee has been appointed to secure information regarding municipal water works and electric lights.

Hamilton, Ont.—This city voted to issue $200,000 bonds for a third water main and the extension of the filtering basin.

St. Paul, Minn.—The board of water commissioners decided March 9 to lay a 16-in. main on the Wabash-st. bride.

Worcester, Mass.—The committee on water has voted to construct a new reservoir on Tatnuck river. F. A. McClure, cy. engr.

Attleboro, Mass.—The water department will replace cement pipe with cast iron pipe. L. Z. Carpenter, supt. w. w.

Pittsburg, Pa.—Director E. M. Bigelow will begin in April making experiments and tests with the proposed meter system.

New York City.—A bond issue of $500,000 to provide an additional water service for the Bronx has been requested.

Columbus, O.—A resolution was adopted March 13 advocating the issue of $350,000 bonds for the extension of the water mains.

Wilmington, Del.—Bids will probably be asked for a high duty pump for supplying the tower in Rockford park.

Highland Park, Ill.—An ordinance has been passed appropriating money for a sand bed filter in the lake to purify the water.

Silverton, Col.—An ordinance was passed March 5 to vote on the question of issuing bonds to build or purchase a water plant.

Ashland, Neb.—The question of issuing bonds for a new boiler and new pumphouse for the water works system will be voted on April 3.

Zanesville, O.—A bill has been passed authorizing this city to vote on the question of issuing $62,500 bonds for water works extensions.

Philadelphia, Pa.—The bill appropriating $12,000,000 for the improvement of the water supply has passed both branches of the council.

Jackson, Miss.—The question of issuing $25,000 bonds for the increase of the water supply will be voted on April 2. W. J. Caldwell, recdr.

La Crosse, Wis.—Plans have been completed for the proposed water main extension in the downtown district. F. C. Powell, cy. engr.

Vandalia, Ill.—An ordinance has been passed providing for the extension of the water works. J. R. Schulte, mayor; J. O. Gunn, cy. clk.

Troy, N. Y.—A bill has been introduced in the senate which provides for the extension and improvement of this city's water supply system.

Ogdensburg, N. Y.—The bill authorizing the expenditure of $15,000 for improvements to the water supply has been signed by Governor Roosevelt.

Atlantic City, N. J.—A bill has been signed authorizing the expenditure of $1,500,000 for extending and maintaining a municipal water plant.

St. Louis, Mo.—The city council passed a bill March 23 appropriating $50,000 for experimenting in the filtration of the city's water supply.

Wilmette, Ill.—Charles Clark, C. E. Latham and L. H. Field have been appointed a committee to investigate the question of building a water works system.

Dayton, O.—Bids will be asked soon for a 10,000,000 gal. pump and 2,000 ft. of 5½ ft. steel suction pipes. Chas. E. Rowe, sec'y. bd. W. W. trustees.

Camden, Me.—At a town meeting held March 19 it was decided to appropriate $1,000 to meet the expense of preparing to introduce a water works plant, estimated cost $60,000.

Syracuse, N. Y.—John H. Moffett, superintendent of water bureau, advocates the placing of a large water meter at the outlet of Skaneateles lake, estimated to cost $3,000.

Morehead, Ky.—W. W. Rice wishes to correspond with manufacturers of water pipe, pumps, water and electrical supplies, and contractors for water works and electric light plants.

Municipal ownership of water works is being considered at the following places: Traverse City, Mich.; Annapolis, Md.; Greenville, S. C.; Omaha, Neb.; Meridian, Miss.; Stockton, Cal.

San Diego, Cal.—Surveys have been made for the proposed Otay flume for conducting water from the Otay reservoir to the Chula Vista and National City water system; estimated cost $35,000.

Cedar Rapids, Ia.—Surveys are being made for the location of the proposed new water works pumping station, settling basins and filteration beds. Cy. Engr. Meredith.

Holly Springs, Miss.—A bill has been approved by the governor authorizing the issue of bonds for the enlargement of the water works and electric light, and the establishment of a sewerage system.

Des Plaines, Ill.—(Special.)—Plans for sinking a 5 ft. brick shaft to a depth of 117 ft., in place of the present 8 in. well, for the purpose of increasing the water supply are being made by R. C. Huston, C. E., of Chicago.

Lewiston, Ida.—(Special.)—The city council has offered the Lewiston water & Light company $69,500 for its water works system. If the offer is not accepted it is probable that new water works will be put in at an estimated cost of $90,000.

The question of issuing water works bonds has been favorably voted on as follows: Herman, Minn.; Iola, Kas.; Stillwater, Ok.; Kenmore, N. Y.; Osakis, Minn.; Saranac, Mich.; St. Mary, Va.; Slayton, Minn.; Adams, N. Y.; Warren, Pa.

The question of issuing bonds for water works will be voted on as follows: Hammond, Wis.; LeRoy, N. Y., April 3; Glenwood, Mich., April 9; Ord, Neb., April 17; Luray, Va., April 2; Sonona City, Cal., April 7; Blakely, Ga.; St. Charles, Mo.; Gowrie, Ia.

Washington, D. C.—The State Department received a telegram from Richard T. Greener, U. S. Consul at Vladivostock, the eastern terminus of the Trans-Siberian railway, March 20, saying that estimates had been prepared for water works, electric lights and on electric trolley tramway and that proposals were desired from the United States.

The construction of water works systems is contemplated at the following places: Lostant, Ill.; Monteagle, Tenn.; Schulenburg, Tex.; Beeville, Tex.; Sisseton, S. D.; Cameron, Mo.; North Yakima, Wash.; Grand Meadow, Minn.; Kensington, Md.; Heber City, Utah; Schuylersville, N. Y.; Arnprior, Ontario, Canada; Edison Park, Ill.; Dennison, Tex.; Bowdle, S. D.; Havre, Mont.; Genesee, Ida.; Onaway, Mich.; Arlington, Ia.

BRIDGES.

Swan, Ia.—An iron bridge across the Des Moines river is proposed.

Goffstown, N. H.—The sum of $5,000 has been voted for a new bridge.

Rockford, Ill.—Bids will be asked for soon for the North Town bridge.

Fisherville, Ont.—The construction of three steel bridges is favored.

Omaha, Neb.—A bridge over the Pappio, near Bennington, is proposed. Co. Comr's.

Boston, Mass.—A bridge over Fort Point Channel at Oliver-st. is proposed.

Houston, Tex.—A bridge across the bayou at the foot of Main-st. is proposed.

Zanesville, O.—The question of building the Y bridge will be voted on April 10.

Linden, Pa.—A bridge across the river in Woodward and Susquehanna townships is contemplated.

Newport News, Va.—Bids will be asked soon for a bridge across Twenty-eighth-st. Spec. bridge com.

Darby, Pa.—A petition has been circulated for a new bridge over Darby creek on the Chester pike.

Preston, Ia.—A petition is being circulated for a steel bridge over Deep creek. Mayor Bartholomew.

Clinton, Ind.—Bids are asked until April 19 for a bridge across the Wabash river at Perrysville.

Waterford, Ind.—The citizens of this town have petitioned the county commissioners for a new bridge.

Wahoo, Neb.—The county commissioners have been petitioned to build a bridge across the Platte river near Yutan.

Warsaw, Ind.—Bids will be received April 19 for three bridges over the Tippecanoe river. W. Y. Chamberlain, co. engr.

Waco, Tex.—The question of issuing $100,000 bonds for a bridge across the Brazos will be voted on April 28.

Highland Park, Ill.—Bids are asked until April 6 for two bridges, and for raising one bridge. Clk. Bd. Local imp.

Jasper, Ala.—Sealed bids are asked until April 6 for a bridge across Sipsey river. Jas. W. Sheppard, Judge Probate.

Des Moines, Ia.—A contract was awarded to J. H. Kilmar, March 21, for a Melan arch bridge at N. Sixth-st. for $76,000.

Rapid City, S. D.—Sealed bids will be asked soon for building a bridge across Rapid creek. Horace Crockett, co. audt.

Piqua, O.—The county commissioners have been asked to build an iron hoist bridge over the Miami and Erie canal at Ash-st.

Philadelphia, Pa.—The erection of a bridge to carry Seventeenth-st. over the tracks of the Reading railway is contemplated.

Muscatine, Ia.—Bids are asked until April 2 for furnishing all iron bridges during the ensuing year. E. C. Stocker, co. audt.

Bristol, Conn.—A new iron bridge to replace the present wooden one across the Pequabuck river at East Bristol is proposed.

Niagara Falls, N. Y.—A steel arch bridge between Prospect park and Bath island at the Niagara reservation is contemplated.

New York City.—The report of the committee on bridges and tunnels to build a bridge across Newton creek will be reconsidered.

Helena, Ark.—Bids are asked until April 12 for building five steel bridges in this city. J. C. Barlow, Chmn. Bd. Pub. Affairs.

Portland, Mich.—The construction of a new iron bridge overlooking Glass river is recommended by Commissioner Sessions in his annual report.

Dubuque, Ia.—The city council appropriated, March 15, the sum of $25,000 for the proposed Eagle Point Highway bridge across the Mississippi.

Jersey City, N. J.—Bids are asked until April 5 for building a steel bridge over the Penn. R. R. cut at Baldwin-ave. John P. Egan, Clk. bd. Chosen Freeholders.

Libertyville, Ill.—Sealed bids are asked until April 6 for building a steel bridge over the Desplaines river in Vernon. C. C. Garbert, Clk. Com. Half Day, Ill.

Chicago, Ill.—Sealed bids will be received until May 15 for a movable bridge over the Calumet river at Ninety-fifth-st., and until June 1 for a moveable bridge over the North Branch Canal at Division-st. Commissioner McGann urges the need of building twelve or fourteen bridges this year to replace structures that have fallen in the river or have been closed. L. E. McGann, Com'r Pub. Wks.

PARKS.

Arlington, Minn.—The Arlington Park Association was incorporated March 17, to establish public grounds for this village.

Akron, O.—Col. Geo. T. Perkins has presented this city with eighty acres of land, valued at $100,000, for park purposes.

Omaha, Neb.—The park commissioners are considering a plan to preserve and purify the waters of the lake in Riverview park.

St. Paul, Minn.—The purchase of property bounded by Lincoln-ave., St. Albans-st., Goodrich-ave. and Grotto-st., for park purposes, is proposed.

New York City.—Plans have been prepared by the park department for improving and beautifying W. H. Seward Park. The boards asks for $92,000 to carry on the work.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Rome, N. Y.—Bids will be asked for street cleaning.

Delavan, Wis.—Mayor Smith has recommended street sprinkling.

Ludlow, O.—The question of building a garbage crematory is being considered

Binghamton, N. Y.—Specifications have been adopted for the collection and disposal of garbage.

Chicago, Ill.—The city council has agreed to appropriate $250,000 for constructing a garbage crematory.

Rochester, N. Y.—August Kimmel secured the contract for removing and disposing of the garbage for one year.

Allegheny, Pa.—Bids will be asked for soon for a three-year contract for the collection and removal of garbage.

Waterbury, Conn.—The contract for collecting and disposing of the garbage for ten years has been awarded to Hubert M. Rigney.

New Haven, Conn.—The New Haven Street Sprinkling company secured the contract for sprinkling the streets at $9,000.

Buffalo, N. Y.—The board of public works has asked for $140,000 for collecting the ashes, garbage, etc., of the city for one year.

Washington, D. C.—Bids are asked until April 20 for the collection and disposal of garbage, refuse, ashes, etc. John B. Wight, comr. D. C.

Minneapolis, Minn.—F. G. Wiselogel has offered to furnish plans and superintend

the construction of a 50-ton garbage reduction plant for $1,500.

Newport, Ky.—Bids for the erection of a garbage crematory have been received as follows: American Incineration company, Toledo, one furnace, $8,850; Dixon Crematory company, Toledo, two furnaces, $14,840; one furnace, $8,200; Davis Garbage Furnace company, Lancaster, Pa., two furnaces, $16,450; one furnace, $8,575.

Watertown, Wis.—(Special.)—A committee, consisting of Mayor H. G. Grule and Aldermen H. Wertheimer and H. C. Mayer, were appointed to ascertain the most approved kind of machine for sweeping paved streets and the cost of the same and report to the council as soon as convenient.

STREET LIGHTING.

The question of issuing bonds for street lighting has been favorably voted on as follows: Ilion, N. Y.; Saginaw, Mich.

Gas City, Ind.—A 50-year franchise for a gas plant has been granted John Q. Thompson, according to press reports.

St. Louis, Mo.—The contract for lighting the streets of this city for ten years was awarded March 16 to the Kern Incandescent Gas Light company.

Chicago, Ill.—The contract for gasoline lighting was awarded March 14 to the American Development company at $17.40 per year for 60 c. p. lights.

Saratoga Springs, N. Y.—The contract for public lighting for four years was awarded March 5 to the Saratoga Gas, Electric Light and Power company.

Baltimore, Md.—The bill to reduce the price of illuminating gas in this city passed the senate March 27 and hereafter gas will be $1.10 a thousand feet.

Mancos, Col.—The question of authorizing the construction of an electric light plant and gas works by a private corporation will be voted on April 3.

Evanston, Ill.—The city council is considering the proposition of the Yaryan company for a 25-yr. franchise for installing a heating and lighting plant.

Reading, Pa.—The contract for lighting this city for 5 yrs. was awarded, March 12, to the Metropolitan Electric company, the company to furnish 700 arc lights at $79.92 each annually.

The question of issuing bonds for street lighting will be voted on as follows: Howell, Mich.; Dillon, Mont.; Spencerville, O., April 2; Arcamon, O., April 2; Kenton, O., April.

Owensboro, Ky.—A contract for a municipal electric light plant is reported as having been awarded to F. F. Vater, of the Chicago department of the Westinghouse company, for about $45,000.

Canton, O.—Bids were received March 17 for supplying this city with street lights, exclusive of the arc light, from the Canton Gas Light and Coke company and the Welsbach Street Lighting company of America.

Columbus, O.—A resolution is being prepared to authorize an appropriation sufficient to build an equip an electric light plant of sufficient capacity to light all the public streets of the city.

Portsmouth, Va.—Bids are asked until April 5 for lighting the streets, market, etc., with electricity, and the public buildings with gas or electricity, for 1, 3 or 5 yrs. Samuel T. Montague, chrmn. com. on lgts.

Electric light plants are contemplated at the following places: Stillwater, Minn.; Milan, Mich.; Adel, Ia.; Hanlontown, Ia.; Huntingburg, Ind.; St. Mary's, Va.; Covington, Ky.; Delta, Col.; Clinton, Wis.; Idaho Falls, Idaho.

TOO LATE FOR CLASSIFICATION.

Port Huron, Mich.—Bids will be asked at once for macadam paving on Gratiot-ave. and Griswold-st.

Rochelle, Ill.—The Iowa Engineering Co., Iowa City, Ia., has prepared plans for a general system.

Brooklyn, N. Y.—Commissioner Keating recommends asphalt and granite repaving for a large number of streets.

Rockford, Ill.—W. State-st., from Winnebago to Avon, will be macadamized. Objections will be heard April 4.

Van Wert, O.—Sealed bids are asked until April 20 for constructing a stone sidewalk on Main-st. T. M. Berry, co. audt.

Dayton, O.—Sealed bids are asked until April 20 for building sewers in dist. No. 9 (Riverdale). P. E. Gilbert, prest. B. C. A.

Grover Hill, O.—An ordinance has been passed to build a 6-in. tile drain in Wayne-st. S. R. Fish, mayor; E. O. Merrick, clk.

Baltimore, Md.—An ordinance for repaving St. Paul-st., from Twenty-fifth to Thirtieth, with asphalt, was favorably reported March 21.

Lansingburgh, N. Y.—The contract for the waterworks extension was awarded, March 22, to P. H. Harrison & Son, of Newark, N. J., for $65,985.

Paoli, Ind.—Sealed bids are asked until April 4 for building gravel and macadamized roads in French Lick twp. Louis P. Brown, chmn. co. comrs.

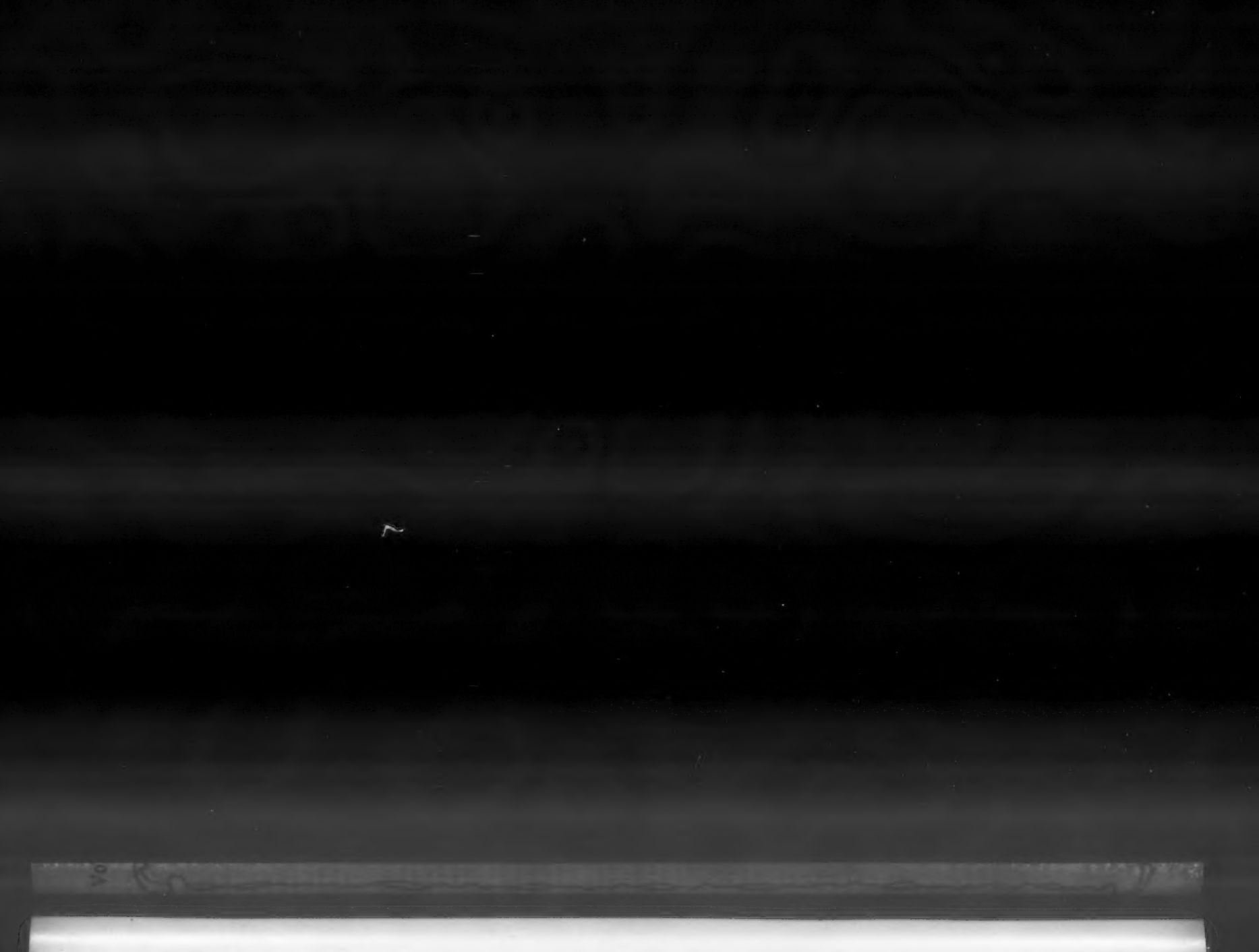
New York City—Sealed bids will be received until April 4 for building seven sewers in Manhattan and one sewer in the Bronx. Dept. Sewers, 13-21 Park Row.

Chicago, Ill.—Sealed bids are asked until April 17 for building intercepting sewers, and for furnishing cast iron water pipe. L. E. McGann, comr. pub. works.

Ft. Wayne, Ind.—The contract for the South Wayne sewer was awarded March 22 to J. T. Adams, Columbus, O., at $7.16 a lin. ft. The board saved $6,509.50 by re-advertising for bids.

New Castle, Del.—The contract for lighting this city for five years was awarded March 20 to the Wilmington & New Castle Electric Railway Co., at $68 each per year for thirty arc lights of 2,000 c. p.

Platteville, Wis.—A contract for lighting this city has been awarded to the Platteville Electric Light & Power Co., at $16 each per annum for incandescent and $55 each per annum for arc lights.

Osceola, Ia.—The contract for street lighting for five years has been awarded at $72.50 each per annum for all night service on moonlight schedule, and $30 eacn per annum for 60 c. p. Bernstein series.

Salt Lake City, Utah.—The city council authorized the board of public works March 20 to advertise for bids for building a reservoir on Ninth-st., for the distribution of the water from Parley's Canyon.